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ELECTRICAL EXPORTS.

The encouraging figures of electrical export trade for January are sustained by those now available for February. The export of electrical appliances for February, including telegraph and telephone instruments, reached a value of $544,906, while for the same month last year the amount was but $418,483. The total for the eight months is $4,064,472 as compared with $3,110,943, a remarkable gain of nearly $1,000,000, or about 30 per cent. This is most gratifying. The showing for electrical machinery is not quite so good, but is nevertheless satisfactory. For the month of February it was $646,532, as compared with $637,479, while for the eight months it is $5,031,898, as compared with $4,669,595. Adding the electrical instrument values to those of the heavier machinery, we have for the eight months an excellent total of $9,096,370, as compared with $7,780,538 in the previous corresponding period. At this rate the grand total of last year will easily be beaten. We should like to see the heavy machinery holding up better, but the returns as to instruments indicate apparently a growing diversity of export in the smaller appliances. In the heavier class the demand has slackened perceptibly from Japan, Australasia, Argentina and the Philippines, but in each of these quarters we look for improvement in due time.

PROPOSED NEW A. I. E. E. CONSTITUTION.

The members of the American Institute of Electrical Engineers have now before them for their action a proposed new constitution for the government of that body. From an accompanying circular we learn that the proposed document is the work of the Committee on Law of the Institute; and upon reference to a printed list of committees we find that the five members of the Law Committee are all residents of New York or vicinity. Without in the least impugning the motives of these gentlemen or of the Board of Directors who have approved their work, we are constrained to say that the proposed document reflects, unconsciously, the spirit which would reserve to the members resident in New York City and vicinity—numbering less than 30 per cent of the total membership—the preponderating influence in the conduct of the Institute. In confirmation of this view we need only to point specifically to two changes which the proposed constitution would introduce into the present organic law of the Institute. In the present constitution any change of the organic law requires the affirmative vote of a majority of the qualified members and associates; according to the proposed constitution, such changes may be made at the annual meeting—which is required to be held in New York City by the law under which the Institute is incorporated—by a two-thirds majority of a quorum consisting of only 200 members and associates, present in person or by proxy. Again, the present constitution provides that no business affecting the organization or policy of the Institute shall be transacted at any other than the annual meeting, which provision was introduced to prevent the recurrence of conditions which at one time threatened to disrupt the Institute. According to the proposed constitution, special meetings of the Institute for the transaction of business

may be called by the Board of Directors at any time; and interpreted in the light of a disclaimer in a following clause, at such meetings business affecting the organization or policy of the Institute may be transacted. As there are over 700 members of the Institute in New York City and Brooklyn alone, the facility with which a quorum may be obtained for the amendment of the constitution or change of Institute organization or policy, is apparent.

Still another safeguard to the interests of outlying members which the proposed constitution would remove is the clause in the present constitution requiring that the names on the official ballot for the office of vice-president shall be selected from the nominees' list with a view to maintaining a geographical distribution of the incumbents of this office, which clause has been omitted from the proposed constitution. Yet another point to be noted in this connection is that while the article which was introduced in the present constitution to secure attendance at the annual conventions of representatives of the various geographical sections of membership, has been retained in somewhat changed form, it lacks a clause whereby its execution may be secured. Such a clause is unfortunately absent in the present constitution, for which reason the article has remained a dead letter. It may be added that proposed additions to the by-laws and to the constitution to remedy the defect have in the past been uniformly rejected. The above points affect more particularly the 70 per cent or more of members not resident in New York or vicinity. A proposed clause which affects all members alike is one which makes a concession to "an engineer in an allied branch of engineering" with respect to eligibility to full membership. During the past ten years admission to full membership in the Institute has been so carefully guarded, and this grade has been kept to such small proportions, that great weight has become attached to membership in that grade. This, we believe, is well understood by engineers in other professions, but it is questionable whether such engineers should be allowed entrance to the grade under conditions notably less onerous than those which apply to an associate of the Institute desiring transfer to full membership.

Aside from the above considerations and other objections that could be adduced against the proposed constitution, the wisdom is questionable of changing the organic law of the Institute at this juncture, in view of the many unforeseen questions likely to come up in connection with its finances and policy upon the occupancy of the new Engineering Building. One point alone need be mentioned, and that is the probability of the future financial situation requiring the assessment of an extra fee on those members who will derive the greater share of benefit from the maintenance of an elaborate headquarters; and this contingency carries with it the issue of organizing the members in New York and vicinity into a local branch on the same basis as other local branches. In fact, indications point to a reorganization within a few years of the Institute on a truely national basis. And we believe no one will dispute that this work will call for a constitutional committee whose membership shall represent every section of the country.

The Niagara-Syracuse Transmission.

We are glad to be able to give a report of progress on this, by far the most important transmission on this side of the continent. Hitherto the great plants at Niagara have engaged in power transmission only in a rather modest way, attempting neither very high voltage nor very long distance. This plant at last rivals the great work done on the Pacific Coast. It is to be pretty nearly a sraightaway transmission for about 160 miles. The generating plant being on the Canadian side of the river, some international questions as to the exportation and importation of power were raised. These, however, being satisfactorily settled, the work is being pushed rapidly to completion. The river crossing with its long spans and great changes of level has involved some mechanical difficulties which seem to have been very well managed by the use of cantilever arms on the cliffs taking the weight of the downward sweeping cables to the crossing towers at the water's edge. The line itself is an interesting structure representing somewhat novel and advanced ideas. The western half of the line is carried upon steel towers spaced 550 ft. apart. These differ from the usual windmill type in having three legs instead of four, although the latter are to be used on some of the work. Each tower carries a top insulator and a single cross arm with the other two insulators, and the whole tower system is to be in duplicate, each tower line carrying a single circuit.

On the eastern half of the line rudimentary A-shaped towers of wood are being used spaced 220 ft. apart. The relative cost and reliability of these types of construction will prove an interesting study. One point in particular, the effect of lightning in the two cases, respectively, will well bear watching. The country is one in which Jupiter Tonans gets in good solid work nearly every summer, and the weak points of the line will be pretty thoroughly tested out. A line of 55-ft. steel towers is likely to catch everything that is due in the vicinity, and the interesting topic of inquiry is whether the lightning will dodge the insulators or take them along. Duplicate lines are a very important safeguard in this test, and they can be placed far enough apart on the ample right of way to be fairly independent of each other. The voltage is to be 60,000, the present limit with anything like a proper factor of safety on the insulator. Recent insulators are showing considerable improvement in design, so that one may reasonably expect the voltage limit to be raised again before long. A voltage of 60,000, however, is high enough to be satisfactorily economical even on so long a line as that proposed. We shall be exceedingly interested in watching the performance of this long circuit in point of regulation. It forms essentially a linear distribution, the most difficult type to regulate. Fortunately, much of the power will probably be used for railway and miscellaneous motor service and comparatively little for lighting. On account of the low frequency all the important lighting work is likely to be done by means of frequency changers which are capable of independent regulation and require merely constancy of periodicity, which is relatively easy to secure. Even so, regulation is a considerable problem on this circuit. None of the long Western lines has so difficult conditions to contend with, since in each case these circuits carry the main load at or near the end of the run. Even the long stretch between Oakland and San Francisco is reinforced at Mission San Jose by the circuits from Electra.

We are glad to note in the work of the Ontario Power Company the care that has been taken to avoid marring the scenic

effects at the great cataract. Whether any concealment of causes can remedy the effect of withdrawing so great quantities of water from above the falls remains to be seen. The projects now authorized involve a material fraction of the flow, but what the actual effect will be depends, of course, on conditions yet to be disclosed. There is little likelihood that the cataract will be reduced to the ghastly dribble prophesied by some of the yellow journals. If, as we hope, the effect will be merely to reduce somewhat the depth of the tremendous sheet that plunges over the brink, the spectacular result will be hardly diminished at all. The dynamic importance of this to the greatest cataract in an inhabited portion of the world is so immense that it can hardly be overestimated. It can never be restored to its pristine majesty as a spectacle while the works of man crowd around its brink. The mere withdrawal of part of the prodigious volume of flow is from the æsthetic standpoint of far less malign significance than the garish structures that mar the sky line above the cliffs. The transmission work now in progress is a thing to be encouraged by those who honestly wish to preserve Niagara, for it places the structures of utilization miles away. Niagara could, if to-day unemployed, be industrially developed even to the half of its volume and still remain unique in splendor, for well-concealed power plants could distribute the energy over 10,000 square miles. As things now stand, the cataract should fear the hotel man and the advertising fiend far more than the electrical engineer. Niagara crowned with its perpetual aureole of spray and thundering through the dark aisles of the primeval forest, must have had a majesty that should have stayed forever the hand of the vandal; but Niagara fronted by a steel bridge and decked with a frowsy coronet of cheap hotels and factories does not even rise to the full dignity of enlightened utilitarianism.

The Parallel Operation of Synchronous Motor Generator Sets.

As abstracted in our issue of March 31, Mr. J. B. Taylor's paper, before the American Institute of Electrical Engineers March 23, gives a very clear description of some of the peculiarities presented by the service of paralleled synchronous motor-generator sets. The necessity for such motor-generator sets occurs at the interconnection of any two alternating-current systems employing different frequencies; as, for example, where a power-distributing system operating at 25 cycles-per-second, supplies a lighting system already installed for 60 cycles-per-second; or a lighting system with alternating arcs, which cannot operate at 25 cycles-per-second. Moreover, as electric systems continue to expand, they come into boundary contact with each other, and tend to consolidate by economical evolution. They may have originally been installed at different frequencies, and it may be much cheaper to tie them together for exchange of power by alternating-current motor-generators than to discard all the generator apparatus belonging to one frequency. Although the commonest 'synchronous motor-generator is that which transforms from 25 to 60 cycles-per-second, or vice-versa, yet the table of twenty types of machines in Mr. Taylor's paper include no less than 15 frequencies that are occasionally met with, namely, 16⅔, 24, 25, 30, 33⅓, 35, 40, 50, 58⅓, 60, 62½, 66⅔, 75, 100 and 125 cycles-per-second. The fact that any change of frequency in passing from one distributing circuit to another calls for a sub-station and one or more pairs of synchronous machines, each pair on a single shaft, shows how desirable it is to retain as few frequencies as possible in general service. In other words the unnecessary multiplication of frequencies breeds parasitic and wasteful distribution expenditure, in real estate, building, rotating machinery, switchboards, power-losses, oil, waste, attendance, inspection and administration. Moreover, when two different frequencies have to be introduced, to satisfy either physical or economical needs, the requirements of synchronous motor-generators are more easily met, when the frequencies selected bear a simple one-to-two ratio, such as 25 to 50; or 30 to 60 cycles-per-second. For this reason, our present frequencies of 25 to 60 place greater difficulties in the design of synchronous motor-generators than would otherwise be necessary. Nevertheless, it is much easier to criticise than to rectify; for so much capital has already been invested in machines of these frequencies, that to change to a simpler numerical ratio would be most difficult.

The paper shows very clearly that it is one thing to synchronize the motor-side of a motor-generator set, but quite a different thing to synchronize the generator-side, after the motor has fallen into step. If our standard frequencies were either 25 and 50, or 30 and 60, this difficulty would not arise. It would then only be necessary to synchronize the motor, and to close the switches of the generator. As it is, however, with standard frequencies of 25 and 60, when transforming up between these numbers, there is only one chance in five that, after synchronizing the motor side, the phases are right on the generator side for throwing in. If, on the other hand, the machine is transforming down from 60 to 25 cycles-per-second, it is only one chance in 24 that the phases are right on the generator side, after first synchronizing the motor. With the various types of motor-generator described in the paper, the chance of getting the generator in right phase at first motor synchronization is all the way from certainty to one in 2, 3, 5, 6, 7, 10, 16 and 24. From this point of view, the motor-generator may be regarded as the machine which introduces the doctrine of probabilities into the already complicated pathway of central-station practice. Even now, it is occasionally a matter of wager between switchboard attendants at motor-generator sub-stations, how many times they may have to slip magnetic cogs, or poles, on the motor side of a machine about to be thrown in, before the generator switches can be closed. Another very interesting point brought out in the paper is the degree of mechanical accuracy called for in the machining of key-ways in the rotors of synchronous motor-generator sets. Five degrees of phase displacement between the armatures of two bipolar alternator armatures; i. e., five magnetic degrees, may cause a very appreciable disparity between them when sharing loads in parallel. But in an alternator of, say, twelve pairs of poles, a usual number in the generator-field of one of these motor-generator sets, five degrees of magnetic displacement will be produced by five-twelfths of one degree of mechanical displacement, a very small deviation in adjusting a key-way. A case is described in which two similar sets differed 20 per cent from each other in load, when running together, until one rotor was taken off the shaft and a new key inserted, giving the rotor an offset of a few hundredths of an inch. This wonderful principle of magnetic vernier action in multipolar structures might prove useful in maintaining definite minute angular displacements between revolving systems for any desired purpose.

Incandescent Lamp Litigation.

Mr. George Campbell, president of the Germania Electric Lamp Company, has instituted suit in the United States Circuit Court of the Southern District of New York against the Edison Electric Light Company, making claim for the sum of $500,000 on the grounds that the defendant by its actions has destroyed the plaintiff's business and ruined him financially.

In the bill of complaint it is stated that the plaintiff had been doing business under the name of the Germania Electric Lamp Company at Harrison, N. J., in which business he had invested in actual cash the sum of over $50,000. The sales of lamps grew from a total of 35,000 in 1902 to a monthly output of 12,500 lamps, the latter representing a net profit of $750 per month; and it is contended that if the plaintiff had been permitted to continue his business, this output without any doubt would have increased within the next twelve months to 50,000 lamps per month, representing a net profit of $3,000 per month.

It is alleged that the defendant co-operated in organizing and associating manufacturers of incandescent lamps throughout the country into a combination having for a purpose to drive out of business all makers of lamps refusing to join the combination, and to establish and control prices and other trade conditions and thereby to stifle competition, both as to production and distribution, throughout the United States, and that the defendant, both by promises and threats of lawsuits against him and his customers, endeavored to force the plaintiff to join the combination, threatening that unless he did so and agreed to the terms offered, shipments of goods would be followed up and he and his customers would be sued; and upon the plaintiff's objection that the patent upon which they proposed to enter suit against him was worthless, it was replied that whether it was worthless or not, it nevertheless served them well enough and answered all of their purposes.

The patent referred to is the leading-in wire patent No. 444,530, granted to Thomas A. Edison, January 13, 1891, on an application dated September 15, 1890, and subsequently assigned to the defendants. On July 12, 1905, application for a reissue of the patent was made, which reissue was granted under date of October 10, 1905.

The plaintiff states that the improvement on which this patent was granted was continuously used and employed by all incandescent electric lamp manufacturers more than two years prior to the month of January, 1891, and as early as 1884. In the month of March, 1904, suit was instituted against the plaintiff on this patent. But, in spite of the fact that the evidence in this suit had all been taken and the case was virtually ready to be submitted to the court for final decision, the suit was discontinued by the defendant on December 4, 1905, and the court costs paid by it, for the reason, the defendant avers, that the effort to intimidate and coerce him by suit and otherwise had failed, and the defendant knew that if judgment were rendered in that suit it would disclose and establish the worthlessness of the said patent, knowledge of which worthlessness, moreover, it possessed prior to the institution of the suit. The plaintiff further charges that during the year 1904 the defendant, in order to destroy his lamp business, caused to be sent out many intimidating letters to his customers declaring that in using or selling Germania lamps they became infringers of the above-mentioned patent and liable to damages, and threatening to prosecute all such offenders to the full extent of the law.

Hydro-Electric Development in India.

The East Indian press has discussed lately the possibilities of utilizing the enormous quantities of water running to waste now year by year during the monsoon in the Ghats, near Bombay. It was the late Mr. J. N. Tate who first brought the idea of utilizing the Ghats into practical shape. The result of this investigation, continued by his sons, principally under the supervision of Mr. B. J. Padeshah, has been that an English company was formed last summer, consisting besides Messrs. Tate, of leading London financiers, called the Bombay Hydro-Electric Syndicate, Limited, for the purpose of completing and verifying the investigations made, and for bringing the project into effect.

Mr. R. B. Joyner, late superintending engineer to the Indian Government, who has very great experience in questions of water storage, has been busy on the Ghats during the past winter with the final investigations of the hydraulic part of the scheme, i. e., the problem of storing the water falling during the monsoon, which, when conducted through pipe lines down a fall of 1,700 ft., will give the power for supplying current to Bombay. Dr. John Mannheim, of the firm of Alfred Dickinson & Co., of London, the consulting engineers to the Bombay Hydro-Electric Syndicate, Limited, has been, for several months, busily engaged at Bombay, with the electrical part of the scheme. Dr. Mannheim is the electrical expert who visited India last year with Sir Thomas Higham, K. C. I. E., in connection with an important power scheme in the Punjab.

Central Station Commercial Statistics.

The co-operative Electrical Development Association, Cleveland, Ohio, is preparing a report blank which it is proposed to send to central stations in order to secure data relating to commercial methods employed and results secured therefrom. The data of the reports received will be classified in a number of tabulations corresponding to towns and cities of various sizes. It is thought that these tabulations will enable comparisons to be made as to methods and results, and that they will be of service to advertising agencies and others interested in the encouragement of the central station industry. Following is a schedule of the information it is proposed to compile:

Class of plant: Electric, gas and electric, electric in competition with gas or municipal gas or electric.
Sales of electric energy per capita of population in kw-hours.
System of rates; lighting maximum and minimum; power.
Are your mains located both in business and residence districts?
Do you operate 24 hours a day? If not, what hours?
Number of incandescent lamps in circuit.
Number of electric signs in circuit.
Number of buildings outlined.
Number of store windows illuminated.
Number of Nernst lamps in circuit.
Number of tube lamps in circuit.
Number of arc lamps in circuit; commercial; street.
Number of electric fans operated.
Number of power motors installed in shops and factories; in stores; in residences.
Horse-power output of such motors in shops and factories; in stores; in residences.
Number of heating devices in circuit, such as flat irons, chafing dishes, etc., in residences; in stores; in shops and factories.
Available kilowatt capacity above peak load.
If up to capacity when will you increase and how much?
How many isolated plants in your territory.
Do you advertise your services with your own electric sign.
Do you have a downtown office and display room and make a particular point of exhibiting electrical devices and appliances?
Have you an organized soliciting department? Give details as to organization and any special selling schemes used.
If no organized soliciting department, how do you reach prospective customers and handle inquiries?
Are you using any advertising or follow-up service in co-operation with your soliciting? If so describe briefly and send samples for friendly criticism.
Do you advertise in your local papers? If so, attach copies of recent advertisements.
What is the attitude of your local papers on the subject of municipal ownership?
Are you threatened with municipal ownership or rate legislation?
What specific policies besides good service have you adopted to secure good will of public?
What are you doing to secure the wiring of buildings not originally equipped.
What are you doing to secure the wiring of new construction work?
What relations have you established with local real estate dealers, architects, builders, electrical contractors, etc.?
Do you get helpful commercial information from the electrical journals?
What new business or more business subjects would you like to see treated in these journals?
In what ways if any are manufacturers co-operating with you in increasing the sale of current through their devices?
Have you developed any special or unusual applications of electric current other than the usual and well-known ones?
Is there any ordinance prohibiting your use of your kind of poles for advertising purposes?
What is your general attitude on the question of persistent advertising and aggressive personal solicitation in new business and more business getting?

U. S. Governmental Cables.

In addition to its large submarine cable systems in Alaska and the Philippines, it is now stated, in Washington, that the U. S. Government is in favor of operating telegraph and cable lines to Panama and favors the purchase, installation, operation, and maintenance of a submarine cable between Key West, Fla., Guantanamo, Cuba, and the Panama Canal Zone, costing $927,000. Secretary Taft says on the subject: "Experience has demonstrated the dangers of such cable communications being in the power of foreign governments to withdraw the rights of the companies in question, as was particularly emphasized in connection with the cable concessions at Panama. The opinions of these military experts as to the urgency and importance of the situation are strongly re-enforced by the following facts:

"First. That the direct cable from Jamaica to Colon has been interrupted for 14 months, with no prospect of its restoration.

"Second. Complications in connection with the French Cable Company in Venezuela, and violent earthquakes, caused such an interruption of the lines that within the past month no cablegram could reach the northern part of South America from Buenaventura to Para, Brazil, save through Europe.

"The war department is also informed, under date of February 9, by the Central and South American Telegraph Company, that the West Indies cable system, although duplicated, has been interrupted."

This argument is backed up by calling attention to the success that has attended the construction and operation of telegraph lines and cables to Alaska:

"The signal corps lines north of Seattle, known as the Alaskan system, would as an investment have been considered as exceedingly unpromising by commercial companies. The chief signal officer of the army was confident, before it was laid, of its great promise from a commercial point of view in addition to its acknowledged administrative value to the United States in general and to the army in particular. His views were considered somewhat visionary in 1901, but events have abundantly justified them by bringing in gross receipts from commercial sources alone at the rate of $180,000 for the current year, besides doing an unpaid official business of about $100,000 for the United States."

The Telegraphic Situation in England.

Hon. Robert P. Porter, formerly director of the United States Census Office, and now residing in England, has an interesting letter in the New York *Times* of April 9 on the effects of the recent political changes in that country as to government ownership and municipal socialism. He says:

"State control of telegraphs has not turned out a striking success from the commercial standpoint. When the telegraphs were transferred to the Government in 1870-71, the systems in that year showed a profit of $1,710,000, but under State control heavy annual deficits have been the rule ever since. The latest returns, published this week, for the year ending March 31, 1905, show that the excess of expenditure over receipts amounts to nearly $4,610,000, and that, exclusive of this, interest for the year to the amount of $1,358,500 has been paid on the capital expended for the telegraph undertakings, which is nearly $54,500,000.

"The introduction in 1885 of the sixpenny (12 cents) telegrams accounts for a big rise, since it added to the expenditure without increasing the receipts. The number of messages sent since 1903 has dwindled. On the ground of supplying superior service State control, even at a loss, may be justified as promoting the greatest good to the greatest number. But the superior efficiency of the telegraphs is not admitted, and their State control, when large annual deficits are the result, only works out for the greatest good to the least number at the expense of the greater.

"Another cause for the continued shrinkage in the telegraph returns is the greater use of the telephones, which are partly owned by the Government and partly by the National Telephone Company. Here one touches upon a curious position. The trunk lines are in possession of the Government, the company's areas of exclusive service being the large towns, except in the few instances where municipalities have set up opposition exchanges. In 1911 the lines of the National Telephone Company will pass into the hands of the Government Post Office Department, so that the State will then be competing with itself in controlling both the telegraph and telephone systems.

"This step will round off a condition of things under which the development of the telephone in Great Britain has almost been at a standstill. The company has been hampered and overshadowed by the Government monopoly of the trunk systems. Limited tenure and an exorbitant royalty tax have been exacted and the companies have also been at the mercy of periodic changes of Government policy, as well as of municipal opposition to the laying down of underground wires along the streets. The State, in fact, has not taken the telephone seriously, save as a mere auxiliary of the telegraph, a delusion, one may suppose, which is not now likely to last.

"The United States is constantly pointed to as showing the vast field of public usefulness to which the telephone can be applied on the central battery system (which is slowly being extended here) and on the economic basis of regarding a "call" as the unit, fixing the charge on the service rendered. The practice in England is to regard the telephone itself as the unit, and an annual charge for its use is made, whether the number of calls be great or few. This "flat" system of charging subscribers is obviously defective in discouraging the small user, who is charged the same sum as the large user.

"The future indicates that the neglect from which the telephone in this country has suffered will not continue. One may assume that the pending complete State control will be more advantageous to telephone development than the present awkward division of Government and private ownership, whereby the one stands in the way of the other, which meekly has to submit. On the other hand, the State, once in full possession, may stand in the way of itself, for it is known that States are open to the charge of affecting adversely the economic value of undertakings, which hitherto, when under private control, have secured a moderate success, even though hampered by legislative restrictions."

Government Fuel Investigation.

We have received from Mr. F. A. Holmes, fuel expert of the United States Geological Survey, a copy of the final report covering the investigations during 1904 at the fuel testing plant at St. Louis, Mo., under the United States Geological Survey, published by the Government and now ready for distribution. The report will appear in three volumes as Professional Paper No. 48, and will be distributed free of charge. Persons desiring copies of the report should apply for the same to a member of Congress from their district, or to a Senator from their State. Mr. Holmes says: "I am sending you herewith a brief report on certain investigations, submitted to Congress by the Secretary of the Interior, in which the secretary and the director of the Geological Survey recommend the continuance of the fuel investigations, and also the continuance, on a larger scale, of the investigations of structural materials, which during the past few years have been in progress at St. Louis and elsewhere, and in this report Congress is asked to make adequate appropriations for this work. I trust that these recommendations may have your approval. You are doubtless aware of the fact that during the past few years the Forestry Bureau, or Forest Service, of the Government has been conducting certain investigations concerning the strength of timbers and methods of timber preservation, for which work Congress has already made adequate provision.

"In order that all of this investigation work of fuels and structural materials may be brought into closer touch with both the users and the producers of fuels and structural materials, the officers of the national engineering and allied societies were asked to suggest the names of one or more of their members who might be appointed members of a national advisory board on fuels and structural materials, under the advice of which board these investigations by the Geological Survey, and also the timber

and timber-treating investigations by the United States Forest Service, are to be conducted. The suggestion has met with hearty and general approval. The list of persons selected from the membership of these societies has been presented to President Roosevelt; he has formally approved the plan, and has appointed these persons as members of the National Advisory Board for Fuels and Structural Materials."

The list of members of the National Advisory Board includes from the American Institute of Electrical Engineers, Prof. F. B. Crocker, of the Department of Electrical Engineering, Columbia University, New York City, and Mr. H. G. Stott, superintendent of motive power of the Interborough Rapid Transit Company, New York.

Wireless Telegraph Litigation.

Judge Wheeler, of the United States Circuit Court for the Southern District of New York, rendered an opinion April 7 in a case involving a type of wireless telegraph receiver which has been subject to prior litigation between the National Electric Signaling Company and the American De Forest Wireless Telegraph Company. Our issue of October 21, 1905, gives an account of this previous litigation, in which it was held that the De Forest Company infringed a receiver of electromagnetic waves described in a Fessenden reissued patent (No. 12,115) owned by the National Electric Signaling Company. What was then held to be an infringement of this patent and specifically enjoined consisted of an extremely fine wire terminal connected with the aerial wire and entering a liquid solution of caustic potash in a liquid circuit between this fine terminal and a larger electrode connecting to ground. The question in the present suit is whether the use of a metal strip 1/32 of an inch wide, but enclosed in glass to the extreme edge, leaving an extremely fine area touching the surface of a similar liquid to that of the patent, is an infringement.

The court held that this so-called flush terminal is an infringement of the Fessenden patent. The defendant contended that a prior patent issued to De Forest and Smythe covered the form of receiver alleged to be infringed, but the court held that this patent does not show or hint at such a terminal in such an arrangement as that of the Fessenden patent; that the flat and extremely thin strip does not appear to operate any differently from the extremely fine wire of the Fessenden patent; that the shape whether flat or round is not material, nor does the touch of the fine strip to the surface of the liquid appear to act any differently from that of the extremity of the wire of the patent projecting such a short distance into the liquid; that not the form but only the fact of the contact is material. The decision was that the device was an infringement of the Fessenden patent and its use, therefore, a violation of the injunction granted in October of last year.

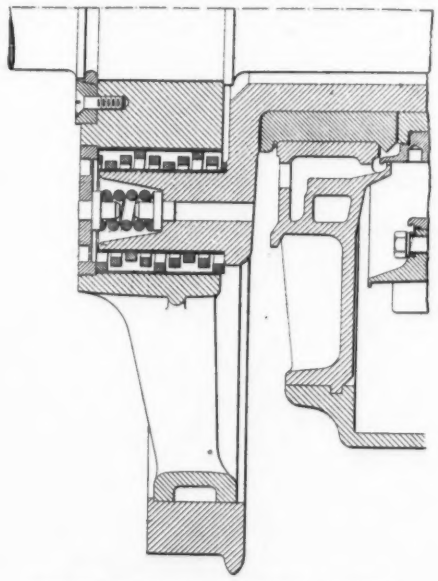
Sociological Effects of the Telephone.

The "oyster king" of New York City has just been "put out of business" and has lost his monopoly of the trade because of the telephone. The connection between cause and effect, and the bankruptcy of the bivalve monarch is thus explained. Instead of going over to the docks on the Hudson River to buy oysters nowadays, the big hotel and restaurant managers simply ring up the oyster planter on the telephone and order oysters direct, or give the order to the oyster agent, who telegraphs it to the planter. Then the oysters arrive by railroad train. That, they say, puts the oyster barge business "in bad," and forces many of the old-time barge captains to the wall. The telephones have wiped out the middle man or jobber. Consequently many of the old wholesalers have been driven out of business, and instead of twenty or thirty oyster barges lined up along the North River piers, there are now two or three at the foot of Bloomfield Street.

Another sociological or economic effect of the telephone is noted by the Boston *Herald* as follows: "Even the rural mail carrier is in a measure anticipated by the telephone in many country districts. Now the farmers on the circuit in the Western States, where enterprise is a 'hustler,' and innovations are welcomed instead of being fought, are to receive at least once a day, and perhaps twice, all the important news of the world. The system, it is said, 'is being installed in Minnesota, Iowa and South Dakota, and within six months will be in vogue wherever telephones are used in the rural districts. Not only this, but every schoolhouse will be connected, and while the service is being transmitted a recess will be had, after which the teacher will impart to her pupils the news of the forenoon. The farmers will have an added advantage, for they will get the news twice a day—at noon and at 7 o'clock in the evening.' At first it was thought this would injure the circulation of newspapers, but the reverse is proving true. The appetite for news grows by what it feeds on, and as the telephone operator can give in a twenty-minute talk only a mere bulletin of the news, the daily or weekly paper with 'the particulars' is eagerly waited for. 'The most notable result of the news service,' says the manager of a rural telephone line, 'is the increase in subscribers, and our merchants note a corresponding increase in telephone orders for goods to be sent by the rural mail carrier, while the farmer's visits to town have become less frequent, and are now seldom made when he is not going to market with his produce.'"

Flexible Connection for Gearless Motors.

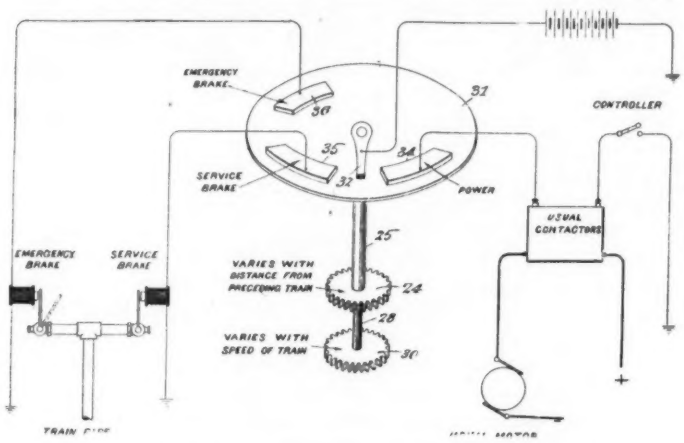
A patent issued April 3 to Mr. R. Siegfried and assigned to the Westinghouse Electric & Manufacturing Company, is of special interest at the present time in view of the rapid development which is now taking place in the use of electric locomotives under steam railroad conditions. The invention relates specifically to means for resiliently opposing relative endwise movement of the propelling and the propelled members when an electric motor is mounted upon quills or sleeves that surround the driving axle of a locomotive. The illustration herewith shows that the driving wheel is provided with a set of annularly disposed chambers into which project a corresponding set of bosses from radial arms at the end of a quill. The bosses are surrounded by resilient and specially-formed helical springs, no two consecutive turns of which are concentric. In the end of the bosses are recesses, from the bottom of which project the free ends of flanged pins. A corresponding set of flanged pins are secured in the end-walls of the chambers. A helical compression spring surrounds the free ends of the pins and serves to relieve the other parts from all shocks resulting from relative axial motion between the quill and the wheel.



SECTION THROUGH BOSS AND SPRINGS.

Control of Train Headway.

A patent recently issued to H. C. Ford, of Syracuse, N. Y., offers a plan for increasing to a maximum the interval between trains in the New York Subway during rush hours, or on other systems where traffic is dense, while at the same time reducing dangers to passengers. In Mr. Ford's system a track is so arranged with electrical devices that the train leaves behind it a zone of influence which is effective to reduce the speed of a following train in case such following train should penetrate the zone of influence. The important point is that the following train merely has its speed reduced, but is not actually stopped. The amount of reduction is proportional to the distance of the preceding train, so that each train is allowed to proceed with as much speed as conditions will permit, but no more. Mr. Ford claims that it is possible thus to make the movement of the trains



SYSTEM OF SPEED CONTROL FOR ELECTRIC TRAINS.

entirely automatic, following one another in close succession. At all times the trains are, of course, under the independent control of the motorman. The accompanying sketch is a diagrammatic representation of the system.

Electric Cooking Lectures in Indiana.

Three central station companies in Indiana recently engaged the services of Mrs. F. Violet Sanborn, the well-known lecturer and writer on domestic science, to give a course of lectures in each town on cooking by electricity. These companies were the Kokomo, Marion & Western Traction Company, of Kokomo, which operates the central station service in Kokomo, the Marion Light & Heating Company, and the Muncie Electric Light Company. The two latter companies are under the management of Mr. George N. Tidd, who, together with Mr. T. C. McReynolds, of the Kokomo Company, arranged for the lectures in these three neighboring towns. Seven lectures were given in each town, six in the daytime and one in the evening. At each lecture an attractive menu of electrically-cooked dishes was prepared. Mrs. Sanborn has for some time given cooking lectures in the interests of gas range business for gas companies, but has recently fallen so much in love with electric cooking that she proposes in the future to devote all of her time to the cleaner and more modern method. At Kokomo Mr. McReynolds, the general manager, was so well pleased with the results that he has arranged with Mrs. Sanborn to give some lectures at Crawfordsville, Ind., where he recently assumed control of the central station business.

At Muncie, which is a rapidly growing town of about 25,000 population, the attendance during the course of seven lectures was over 2,000 persons, and Mrs. Sanborn states that not over 300 were in attendance at more than one lecture. This was in spite of the fact that at Muncie the lectures were given in the Commercial Club Hall, which is on the third floor of a building not provided with elevator service. At Marion the lectures were held in the Carnegie Library. Neat invitations to the lectures were sent out in advance.

Municipal Lighting at South Brooklyn, Ohio.

The village of South Brooklyn, Ohio, was recently annexed to the city of Cleveland. The commissioners appointed to arrange the terms of the annexation made a report on the financial condition of the electric light plant owned and operated by South Brooklyn. This report is now a part of the published legal record of the annexation transaction. As this document was not compiled as an argument either for or against municipal ownership, and as it takes into account depreciation and a sinking fund it has a value in showing the true cost of street lighting from a small plant. Following is the commission's report in so far as it relates to the electric light plant:

Cost of plant to October 1st, 1905, approximately.....$34,000

Number of arc street lamps operated:

First year	79
Second year	84
Third year	100
Total	263

Cost of Operating.

	Sept., '02. to Sept., '03.	Sept., '03. to Sept., '04.	Sept., '04. to Sept., '05.	Combined.
Labor, fuel and supplies	$5,613.41	$6,504.20	$8,341.41	$20,459.02
Deduct income from consumers.	1,080.51	2,352.96	4,627.34	8,060.81
	4,532.00	4,151.24	3,714.07	12,398.21
Interest on bonds	1,500.00	1,500.00	1,500.00	4,500.00
Interest on loan	.....	.....	300.00	300.00
	6,032.90	5,651.24	5,514.07	17,198.21
Cost per lamp	76.36	67.28	55.14	65.40
Depreciation 10 years basis	3,000.00	3,000.00	3,400.00	9,400.00
	9,032.90	8,651.24	8,914.07	26,598.21
Cost per lamp, inc'd depreciat'n.	114.34	103.00	89.14	101.13
Sinking fund, 20-year basis	1,750.00	1,750.00	1,750.00	5,250.00
	$10,782.90	$10,401.24	$10,664.07	$31,848.21
Cost per lamp after providing for sinking fund	136.50	123.82	106.64	121.10

It seems impossible to derive much satisfaction from an exhibit of that kind, from the municipal plant point of view.

Mr. A. O. Benecke.

Adelbert O. Benecke was born July 31, 1855, in Elbing, Germany. After graduating from the college in his native city he entered the University of Koenigsberg, Prussia, where he studied

MR. A. O. BENECKE.

mathematics and natural philosophy from 1876 to 1879. During this period he was an assistant in the physical laboratory under Prof. W. Voigt and an assistant in the astronomical observatory under Prof. Luther, and also served an apprenticeship in a shop engaged in the manufacture of instruments of precision.

From 1879 to 1881 he continued his studies at the University of Berlin under Helmholtz, Kirchhoff, Weierstrass, Kummer and others, and afterward became identified with the manufacture of scientific instruments in Berlin. There were at that time very few men in Germany engaged in that class of work, who combined theoretical knowledge with mechanical ability, and consequently his advice was sought for by many scientists interested in research work for which special apparatus was required. The great variety of work and the continuous intercourse with men of world-wide fame served as a valuable addition to his education.

In 1889 Mr. Benecke came to the United States and soon obtained a position with the Weston Electrical Instrument Company, at Newark, N. J., where he remained for fourteen years as chief electrician and assistant to Dr. Edward Weston. Here he had charge of the laboratories and the designing and experimental work of the company, and participated in all the research work carried on by Dr. Weston, and also acted as expert in the numerous patent suits in which the Weston Electrical Instrument Company was involved. He is the patentee of several inventions relating to electrical measuring instruments and kindred objects.

From July, 1904, to April, 1905, Mr. Benecke traveled through Europe for the purpose of studying physical and electrical laboratory methods and equipments. He is at present chief engineer of the American Instrument Company.

CURRENT NEWS AND NOTES.

VESUVIUS IN ERUPTION.—Mount Vesuvius is in almost unprecedented eruption, 150,000 refugees from the vicinity are in Naples, and the city is stifling in an atmosphere of gases and lava dust. The electric light plant at the Mt. Vesuvius observatory has been destroyed, as well as the restaurant of the funicular railway, which is part of Cook & Sons trolley system up the mountain.

N. E. L. A. TRANSPORTATION.—Mr. G. F. Porter, master of transportation of the National Electric Light Association, advises that the arrangement for reduced rates for the Atlantic City convention in the first week of June has been completed, applying to almost every point in the United States. It is also expected that special train service will be afforded from Chicago, Boston, Buffalo, Philadelphia and New York. Mr. Porter has also issued a full circular on the subject of fares.

INDEPENDENT TELEPHONY IN CHICAGO.—A dispatch from Chicago states that the Illinois Manufacturers' Association has decided to incorporate a $9,000,000 telephone company. A plant sufficient to supply Chicago could be equipped, it is alleged, in two years, or one year before the Chicago Telephone Company's franchise expires. All the 900 members of the association will be given a chance to take shares. Rates have been discussed and it is agreed that $6 a year for a desk telephone will be enough, the instrument itself costing only $1.50. Three cents a call on measured service is thought to be sufficient, though not settled on, and for unlimited service in residences $65 a year with unlimited business service at $100 is proposed.

A FRANKLIN PORTRAIT is being restored to this country by Earl Grey, Governor-General of Canada. It was taken from Franklin's house in Philadelphia by General Sir Charles Grey during the British occupation in 1777, and, as stated by Lord Grey at the Pilgrim Society dinner in his honor in New York recently, has been hanging on the walls of Northumberland Castle for the last 100 years. Until this graceful act of restitution was announced, it had been supposed that Major Andre had carried away the picture, and there was a strong tradition to that effect. It is said to be an admirable portrait. Philadelphians are now discussing the disposal of it. Candidates for the honor of its custody are the Philosophical Society and the Historical Society, but it may go to Independence Hall.

CATARACT POWER POPULAR.—An attack was made recently on the Cataract Power & Conduit Company, of Buffalo, as to its power service from the falls, it being alleged that the prices were too high and were even driving industries away. Offsetting this, the Buffalo *Evening News* presents a very interesting batch of data in two full pages, consisting of a description and map of the system, and of a number of letters from customers. Many of the factories state that they not only find the power cheap but convenient, and much more advantageous than steam. The Great Eastern Elevator has taken 900 hp since 1901, and says that if building another elevator, it would again install electricity. The Urban flour mills state that the loss of time by shut-down has not been 1 per cent of what it would have been with a steam plant. And thus also scores of others.

TURNING ON THE SEARCHLIGHT.—Mr. J. C. Donnell, manager of the Maryville (Mo.) Electric Light & Power Company, whose clever use of his own special paper, the *Searchlight*, has been referred to in these pages, writes as follows: "At our recent election, April 3, the City Council submitted a proposition to our citizens to vote $35,000 bonds to build a municipal electric light plant. This required two-thirds majority. At the same election they submitted a proposition to grant Leeckband & House a 20-year franchise to install a gas plant. This required a majority vote. I proceeded to issue my paper, the *Searchlight*, and am able to report that both of these propositions were defeated; on municipal ownership of the light plant, the vote stood 325 for and 518 against. On the gas proposition it was 245 for and 485 against. This makes three propositions I have defeated them on and now with a new mayor and one in whom I have confidence as a good business man, I expect to contract with the city again."

INDIANA INDEPENDENT TELEPHONY.—The first meeting of the Second district of the Indiana Independent Telephone Association, composed of ten counties in northeast Indiana, was held in Indianapolis April 5. W. L. Mueller, vice-president, presided, and E. M. Popps acted as secretary. Nine new companies were taken into membership, making twenty-six companies represented in the meeting. After disposing of routine business Mr. W. S. Vivian, manager of the Independent Clearing House of the State of Michigan, was introduced, and made an interesting and instructive talk. He described the operations of the clearing house and enumerated the many advantages to be derived from such methods. The members of the association were so much pleased with the plan that it decided to introduce the system. The proposition to cut off from all companies having any connection with the Central Union (Bell) companies brought out a warm discussion and final action was deferred until after the State convention to be held in Indianapolis May 17 and 18.

INDEPENDENT TELEPHONE RATES.—The Indianapolis Telephone Company, successor to the "New Telephone Company," has asked for authority to increase its rates for business telephones from $40 to $52 a year and for residence telephones from $24 to $30. It also asks that the franchise which has seventeen years to run be extended forty years from next July, and that the terms be so modified that the franchise tax be $6,000 a year flat, instead of $6,000 and $2 a year for each telephone over 6,000 in use. The petition asks for the right to make an additional annual charge of $2 a telephone for each 1,000 telephones over 15,000 that may be installed and used. The company now has about 10,000 telephones in use. The petition alleges that the extension of lines and improvements necessary at the present time to provide an efficient service is not warranted by the present income or return on the investment. In consideration of the proposed grant the company proposes to increase the efficiency of the service and to build a half a million dollar fire-proof exchange building and equip it with the latest apparatus and switchboard facilities. The first hearing before the board will be held April 16.

HOTEL WIRELESS STATION.—It is stated that the new Hotel Belmont, at Forty-second Street and Park Avenue, New York City, will be the first hotel in the world to have a wireless station. Its roof is more than 300 ft. above the street level, and the staff to be erected on it by the wireless telegraph company is to be 150 ft. in height. It is said that the station will be available for guests in the hotel.

CHATTANOOGA MEETING OF A. S. M. E.—The American Society of Mechanical Engineers will hold its fifty-third meeting at Chattanooga, Tenn., May 1-4, when several interesting professional papers will be presented. Mr. W. H. Bristol will read one on low resistance thermoelectric pyrometers and compensators, Mr. T. E. Murray will discuss the Tennessee River power plant at Hale's Bar; and Mr. W. O. Webber will give data on efficiency tests of the turbine water wheels. The Hale's Bar power development will be visited, as well as the famous old battlefields in the vicinity.

DENSITY OF TRAFFIC.—It is hard to believe that public cars in New York carry far more passengers than in London, but such appears to be the case. The cheap cab and hansom service probably accounts for a large part of the difference. The omnibuses, trolleys and underground railways of London carried, in 1905, 604,834,000 passengers, as compared with 596,344,528 in 1904, an increase of 8,489,472. The New York State Commission's figures show that the elevated, surface and subway lines in New York City carried 1,442,347,122 during 1905 and 1,341,039,409 in 1904, an increase of 101,307,713, or more than twice the number carried by the transportation lines of London. It should be remembered that the State Railroad Commission's statistics include only the passenger traffic of those lines within the boundaries of Greater New York and do not take into account the immense travel over the vast trolley systems in the New Jersey and Westchester suburbs.

TRANSATLANTIC WIRELESS.—Mr. Abraham White, president of the American De Forest Wireless Telegraph Company, announced on April 7 that wireless telegrams were being sent across the Atlantic Ocean from Manhattan Beach to Glengariff Harbor, County Cork, Ireland, at the rate of twenty words a minute. He gave out a long message which he said was a copy of one sent from him to Dr. De Forest in Ireland, and said: "I wish to announce the successful transmission of aerographic communication across the Atlantic Ocean direct, without a single delay, from Manhattan Beach wireless station, employing 40 kw at the rate of 20 words a minute, to a point on the other side of the Atlantic in Glengariff Harbor, County of Cork, Ireland, where Dr. Lee De Forest received accurately and clearly the messages recently aerographed to him. The following confirmation was received by me on April 6 from Dr. Lee De Forest: 'Messages being read clearly; transatlantic wireless now assured.'" It will be remembered that a year or two ago the Marconi system was successfully employed in sending messages across the Atlantic for the London *Times*.

SUBWAY VENTILATION.—The ventilation of the modern underground electric road is found to be quite a problem, for the public expects much and everything of electricity. The New York Interborough is now to be taken in hand seriously and a system of louvres with automatic valves is to be introduced, if the recommendations of the chief engineer of the Rapid Transit Commission are carried out: Three ways of cooling the Subway by artificial means have been suggested. These are (1) evaporation of water, (2) refrigeration, and (3) the absorption of heat by disposing relatively cool water throughout the Subway. Before any method can be definitely chosen, experiments will have to be made in the summer. The engineer says that "to improve materially the conditions, the air must be renewed more frequently than at present throughout the whole Subway, and, at the same time, recourse must be had to some method of cooling it." The movement of the proposed automatic valves will be dependent upon the movement of the trains. Because the rushing trains increase the air pressure in the Subway and thereby cause the valves to open, as soon as a train has passed a valve the latter will close of itself.

SUBWAYS AND MOTOR BUSES.—The introduction of motor omnibuses in London is said to be having a bad effect on some of the new subways. A special cable dispatch from London of April 7 says: "The very loneliest place in London is the new Baker Street & Waterloo Tube Railway. Now that the novelty has worn off it would seem as if very few find that they want it, for the crowds who frequented it at first have disappeared and little more than fifty occupy the carriages, even at the busiest hours in the morning or evening, when people are scrambling for seats or straphanging on other lines. At other times of the day there is quite a peaceful air about the stations, and a traveler with exclusive tastes would find no great difficulty in getting an elevator which would take him up or down with no other companion save the attendant. From the statistics just published, whereas the number of passengers carried the first week on the Central London Tube was 1,512,176, and since then it has increased, there were only 243,001 on the Baker Street & Waterloo Railway, and that figure has decreased. For the week ended March 31 the receipts were only £1,518 ($7,590)." It is probable, however, that from this point the traffic will begin to build up and increase steadily.

NEW YORK CITY LIGHTING.—The incinerator plant for the electric lighting of Williamsburg Bridge by the city has been illustrated and described in these pages, and our readers will, therefore, be interested in some of the latest developments in connection with this municipal enterprise. An inquiry is now afoot with regard to the street cleaning department from which is obtained the material for the fuel of the plant, and the preliminary investigation opens up an alluring prospect of "graft." One of the things unearthed is in connection with the "trimming" contract held by the contractor, who pays the department $1,200 weekly for his privilege. This privilege of trimming the ashes and refuse generally is considered a gold mine, and the contractor is supposed to have made a fortune out of it. It is now alleged that he has a drawback through another contract for furnishing labor for the incinerator and lighting plant under the Williamsburg Bridge. The Italian laborers he furnished to the department under this contract, it is declared, are paid from $5 to $10 a week by the contractor, the average being $7. From the city he gets 25 cents an hour for the work of the men, and they work twelve hours a day generally. This means $18 a week for the employer. His average receipts from this source, it is said, have been $541 weekly since the first of the year. The rest can be imagined.

ENGLISH MUNICIPAL OBSTRUCTION as to developments and improvements is curiously exemplified in the subjoined cable dispatch from London of April 7: "The American Commission on Public Ownership is busily employed conducting its inquiry in various British towns. Mr. Sullivan is in Glasgow, Mr. Crawford working in Liverpool, Mr. Winchester has joined Mr. James and Mr. Klumff at Manchester and Mr. Maltbie returned to-day from Birmingham. These towns, with Sheffield and Leicester, have supplied thorough studies of the practical operation of tramways and gas and electric supplies by municipal or private corporations, and good tests for a comparison of the results of the preliminary survey have been made in Newcastle, but the ground has not yet been broken in Bristol, and other cities may be substituted for each as a subject of inquiry. The commissioners have been well received everywhere and have exceptional facilities for the systematic examination of the results of municipal ownership. The new motor buses are recognized as a menace to municipal investments in tramways. Some town councils refuse to license them, but competition is generally allowed. Experts assert that their day may be short in consequence of the wear and tear of the mechanism by sudden stoppages in crowded streets and the necessity for constant reconstruction. The motor buses are seriously reducing the receipts of the London underground railways. The new Baker Street tube lacks patronage and is retrenching expenses."

LIGHTING IN CHINA.—U. S. Consul Ragsdale reports a demand for electric lights, water works, etc., in the important Chinese city of Tientsin.

ELECTRICAL ENGINEERING AT CORNELL.—The electrical engineering class at Cornell which will graduate the present year contains 112 members. The total electrical engineering registration is between 500 and 600.

MAXIMUM DEMAND SYSTEM.—According to our English contemporaries the "maximum demand" system of charging for current has received a severe check in the home of its childhood—Brighton—that town having just adopted an alternative flat rate system.

FOUNDRYMEN IN PITTSBURG.—A foundrymen's convention was held in Pittsburg last week, when the local Foundrymen's Association were the hosts, and when special trips were made to the Westinghouse works, especially the large modern foundry plant at Trafford City. At the banquet in the evening the toastmaster was Mr. D. B. Fuller, of the Westinghouse Electric & Manufacturing Company, president of the Pittsburg Foundrymen's Association.

INTERDEPARTMENT TELEPHONE SYSTEM.—A dispatch from Washington states that the Federal Government is about to establish an interdepartmental telephone service in Washington in accordance with the recommendation of the Keep commission. The commission recommended the change as one which would not only provide better service, but would cost less than is at present paid for telephones. The President, it is stated, has approved the report. The service is apparently for departmental use only, and limited to that extent.

MONROE, MICH., MUNICIPALISM.—On April 2 for the third time, an attempt was made in vain to get something done with the municipal plant. The proposition to raise by loan the sum of $8,500 was defeated at the election on that day. This money was to have been spent in purchasing and installing a 250-hp water tube boiler, a 120-kw alternator, a 75-light tub transformer, and 118 arcs, etc. Just what will happen next is not known, but if the plant is not brought up to date with more money, that which has already been spent is virtually lost.

FRENCH WIRELESS TELEGRAPHY.—Advices from Paris state that for some time communication by wireless telegraphy has been possible between the Eiffel Tower, on the Champ de Mars, Paris, and Belfort, on the eastern frontier. At present the engineers are trying to discover in what degree their wireless messages can be intercepted or falsified. An apparatus fitted in the grounds of the Military Aerostatic School at Meudon has been communicating with the office of a divisional commander on the eastern frontier, and at the same time messages have been exchanged between the Eiffel Tower and an apparatus fitted in a captive balloon lying over one of the frontier fortresses. The tower makes an ideal wireless station in many respects.

ELECTRIC TRAIN LIGHTING.—In regard to a recent serious accident on the Great Western Railway, Mr. B. D. Butler, of the Minneapolis *News,* who sustained injuries, said: "There were but a few of us in the car. All of us were badly bruised and shaken up, but none seriously injured. The wreck smashed a gas tank at one end of our car and I was pretty nearly unconscious from the gas by the time some men came and helped me out of the car. The gas eventually caught fire, but the colored porter fought the flames with fire extinguishers and put them out before they had made any headway. He was a cool fellow and deserves credit for keeping his head. Throughout the ordeal the electric lights in the car kept burning, so that we could see everything in the car plainly."

ELECTRICITY IN MINING.—United States Consul McNally, of Liege, Belgium, notes that only 1 per cent of the coal product in that country is mechanical output. In England the machine work is more successful. The total coal production in 1902 was 227,084,871 tons, and the machine product 4,161,202 tons. In 1904 the total production was 232,411,784 tons and the machine products 6,743,744. The machine progress is steady, in 1902 being 1.83 per cent; 1903, 2.27 per cent, and in 1904, 2.90 per cent. The proportion of power used in operating the machinery was as follows: 1902, compressed air, 69.15 per cent; electricity, 30.85 per cent; 1903, compressed air, 64.08 per cent; electricity, 35.92 per cent; 1904, compressed air, 64.24 per cent; electricity, 35.76 per cent.

HOTEL FOR TELEPHONE GIRLS.—A special dispatch from Paris states that comparisons of telephone systems were made recently in debate in the Chamber of Deputies. M. Chastenet declared that there were more telephone subscribers in the city of New York alone than in all France. In Germany, he said, there were 500,000 subscribers, which is far in excess of the number in France. The extent of the urban telephone wires in Germany is 1,500,000 kilometres, and in France 500,000 kilometres. The telephone girls of Paris will soon be quartered in a new residential hotel which is being built for them by the postal authorities. They will be charged low rates for board, and it is expected that the institution will eventually become self-supporting, although it will be subsidized for the present. A receiving room, breakfast room and library are on the ground floor, and a large dining room, which will also be used for concerts and balls, is on the second floor.

ELECTRIC LOCOMOTIVES.—At a meeting on Wednesday, April 4, of the Electrical Engineering Society of Columbia University, at which the members of the New York Electrical Society were guests, Mr. H. D. Hawks gave an illustrated lecture on electric locomotives. The lecture dealt with the compact mining locomotives, the light storage battery locomotives for industrial establishments and the heavy locomotives for service under steam railroad conditions. The advantageous features of the bipolar type of direct-current motor for the severe requirements of locomotives was discussed in great detail, and much information was given concerning the mounting of the motors on the electric locomotives of the New York Central Railroad. A complete description was given of the self-contained gas-driven electric locomotive. In this type of locomotive the gas engine drives a variable-voltage generator which supplies power to direct-current series motors, which propel the locomotive. Since there is no loss in resistances and the control is uniform and without complications, the locomotive shows a low watt-hour consumption per ton mile.

WEATHER PREDICTIONS.—Mr. Willis L. Moore, chief of the United States Weather Bureau, has made a spirited reply to criticisms on his department as to its methods and has defended the long range forecasts that the liberal use of telegraphy and telephony have enabled it to make. He says that during the winter some thirty of the local officers of the bureau in different cities explain in public lectures the work done and the practical science of meteorology, and he adds: "At the dinner of the Maritime Association I made the simple announcement that I believed we had, for the first time in the history of meteorological science, reached a definite basis on which the general character of the weather might be forecast for a considerable period in advance. This step has not been gained by neglecting short-range forecasts in the slightest, because our studies in that line have been carried on independently of our other work. The new principle will not be adopted for official use until after it has been thoroughly tested, and in due time a complete public exposition will be made of it. I made my announcement because I though the public would be interested in knowing that science had at last gained a reasonably firm ground on which it might stand in taking up this important study, especially as astrologers and charlatans have for years been preying upon the credulity of the people and foisting upon them long-range predictions that are based upon no rational principle—that are nothing but the merest guesswork."

Electrical Equipment of Wanamaker's Philadelphia Store.

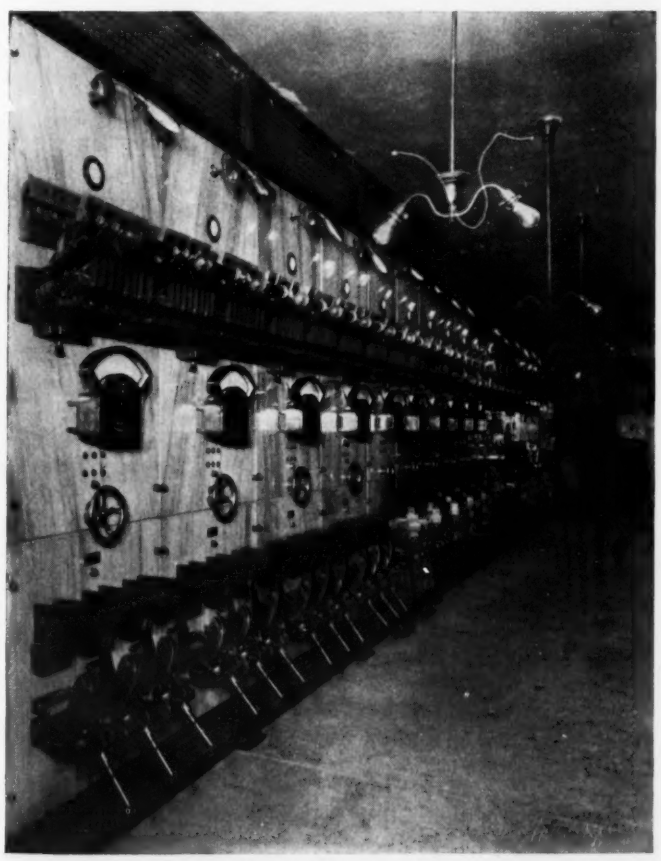
THE modern department store has assumed such proportions as to require the output of a medium sized central station to supply it with the necessary power for the operation of motors and the lighting of lamps. This is especially true of the department store now building in Philadelphia for John Wanamaker, on the site of the old Wanamaker store, where the connected lighting load alone reaches 1,750 kilowatts. Moreover the isolated plant erected to supply this power follows modern central station design in its smallest detail. It is located a block distant from the store in order to eliminate the objectionable features of vibration, heat and odor, inevitable in power generation, and supplies in addition to power for lights and motors, steam, compressed air, water and refrigerating service. By thus isolating the power plant, the entire Wanamaker building may be utilized for purely department store work.

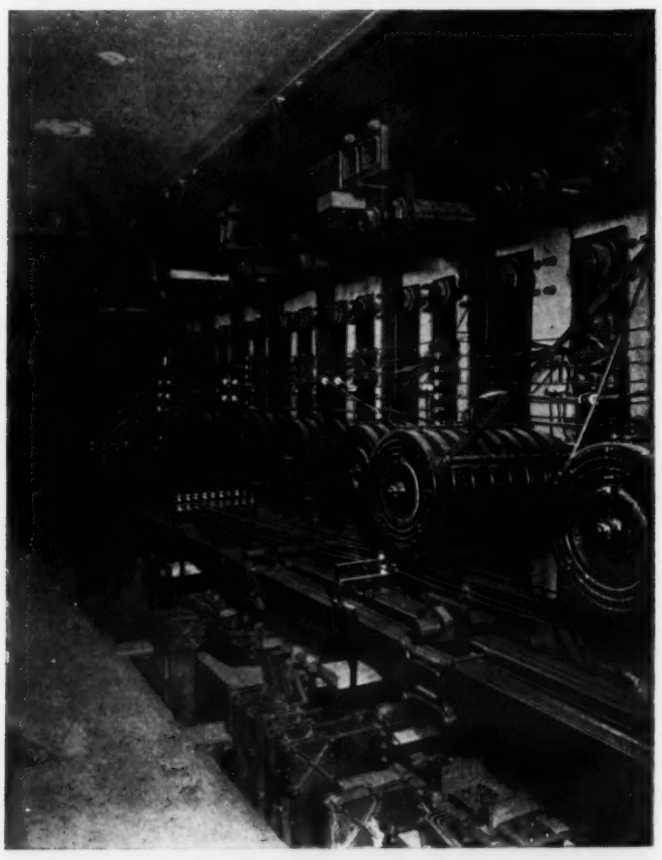
The new Wanamaker store, one quarter of which is already erected and in use, will occupy the plot bounded by Market, South Thirteenth, Chestnut and South Juniper streets, Philadelphia, making it the largest department store in the world. It will be twelve stories high, and will be built in three different sections—north, middle and south, divided from each other by substantial fireproof walls. It is connected with the power house on Ludlow street by a tunnel eight feet high and twelve feet wide, in which are located the steam heating pipes, supply pipes for the hydraulic elevators, high-pressure steam pipes, water pipes, brine pipes, ice water and hot water supply pipes, and above the tunnel and just below the surface of the street are the conduits for the electric feeders.

The power house is a seven-story steel cage structure 165 ft. high. It is fireproof throughout and of remarkably heavy design to provide for the weights carried on the upper floors. The engine room is 62½ ft. high and is divided by a longitudinal wall from the pump room above which are two intermediate or mezzanine floors. The fourth floor, or the one immediately above the engine room proper is devoted to the boiler auxiliaries, and the fifth floor to the boilers. The floor above the

FIG. 1.—ONE SIDE OF ENGINE ROOM, SHOWING ONE-HALF OF THE ELECTRICAL GENERATING EQUIPMENT.

boilers contains the coal and ash bins, while the top floor is devoted to refrigerating apparatus. On the first mezzanine floor, or second story proper, is the switchboard, and on the mezzanine floor above this is the high-pressure steam piping and steam headers feeding the main engines. Taking into consideration the fact that the power plant is erected in the very heart of the





FIGS. 2 AND 3.—FRONT AND REAR VIEWS OF MAIN SWITCHBOARD IN POWER HOUSE SUPPLYING WANAMAKER'S PHILADELPHIA STORE.

business section of Philadelphia and within a stone's throw from the City Hall, the reason for the design of the power house on the above lines is at once apparent.

There are eight Babcock & Wilcox water-tube boilers installed having an aggregate rating of 5,300 hp. The boilers are arranged in two rows, one on either side of the building and facing a firing aisle between them to which coal is delivered from the bunkers above by chutes. The boilers are designed for 200 lb. steam pressure, although the pressure of the supply used is 140 lb., and are fitted with hand-fired Treadkill shaking grates with extension furnaces for the economical combustion of anthracite coal. Each boiler is made up with three 42-in. steam drums and has a total heating surface of over 6,600 sq. ft., and a grate area of 100 sq. ft. Both forced and induced draft are provided. The four blowers supplying the forced draft are situated on the floor immediately below the boiler room and each blower is driven by a 40-hp direct-current motor. The horizontal outlets of the fans connect with the furnace delivery ducts carried on the ceiling of this room directly below the furnaces, so that short, direct connections to the outlets in the bridge walls are possible. The outlets are controlled by levers at the boiler fronts connecting with valves in the branches so that any desired amount of blast may be obtained. The induced draft equipment comprises four steel plate fans designed for a capacity of 51,000 cu. ft. of gas per minute at temperatures in the neighborhood of 555° F., and create a draft of 1½ in. of water when running at 288 r.p.m. Each fan is located directly over the union of the breechings at the rear of each pair of boilers, from which it discharges directly into a short stack. The fans are by-passed so that a direct discharge of the products of combustion may take place if it is desired to operate under natural draft. Each induced draft fan is driven by a 50-hp enclosed steam engine which is supplied with steam from an auxiliary steam header in the boiler room below.

Coal is stored in a 650-ton bin on the floor above the boiler room, and four hoppers set in the floor form the delivery outlets to which the spouts in the boiler room are connected. To the front of this bin is also a 75-ton ash pocket for the temporary storage of ashes. The coal and ash-handling system is very complete. The conveyor system encircles the boiler room and coal and ash bins, passing down the front of the building to a coal receiving pocket into which the coal is dumped directly from delivery wagons on the street. From the receiving pocket the conveyor passes upward 50 ft. to the floor below the boiler room and under the ash chutes. After traveling along this floor a distance

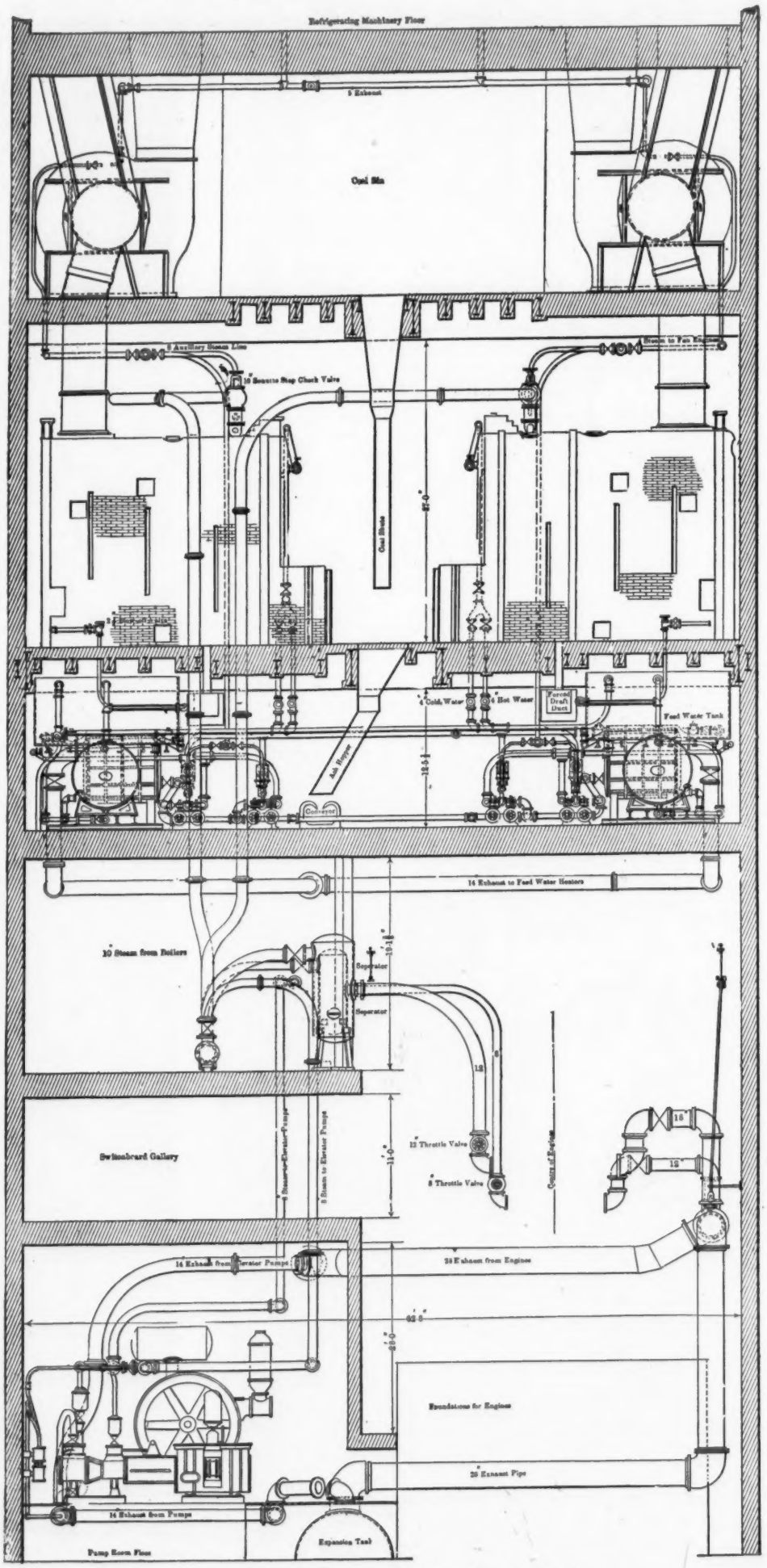


FIG. 4.—SECTIONAL ELEVATION OF WANAMAKER POWER HOUSE.

of 75 ft. to the northern wall it passes upward to the discharge track over the coal bunker a distance of 60 ft. By means of a movable dumper, the loaded buckets are tripped and emptied at any desired point in the bins. Equalizing gears driven by a 25-hp enclosed motor impart a smooth and uniform traveling speed to the conveyor of 45 ft. a minute at which speed the capacity of the conveyor system is 45 tons an hour. Ashes

heating system, etc., the make-up water being taken from the city mains. Four open feed-water heaters are in use, each rated at 1,500 hp. The exhaust steam connections to the heaters are made under the floor by a 14-in. connection from the atmospheric riser of the exhaust system in the pipe shaft in the rear of the building. This riser is a 28-in. pipe leading from the engines and pumps to the roof and connects in the basement

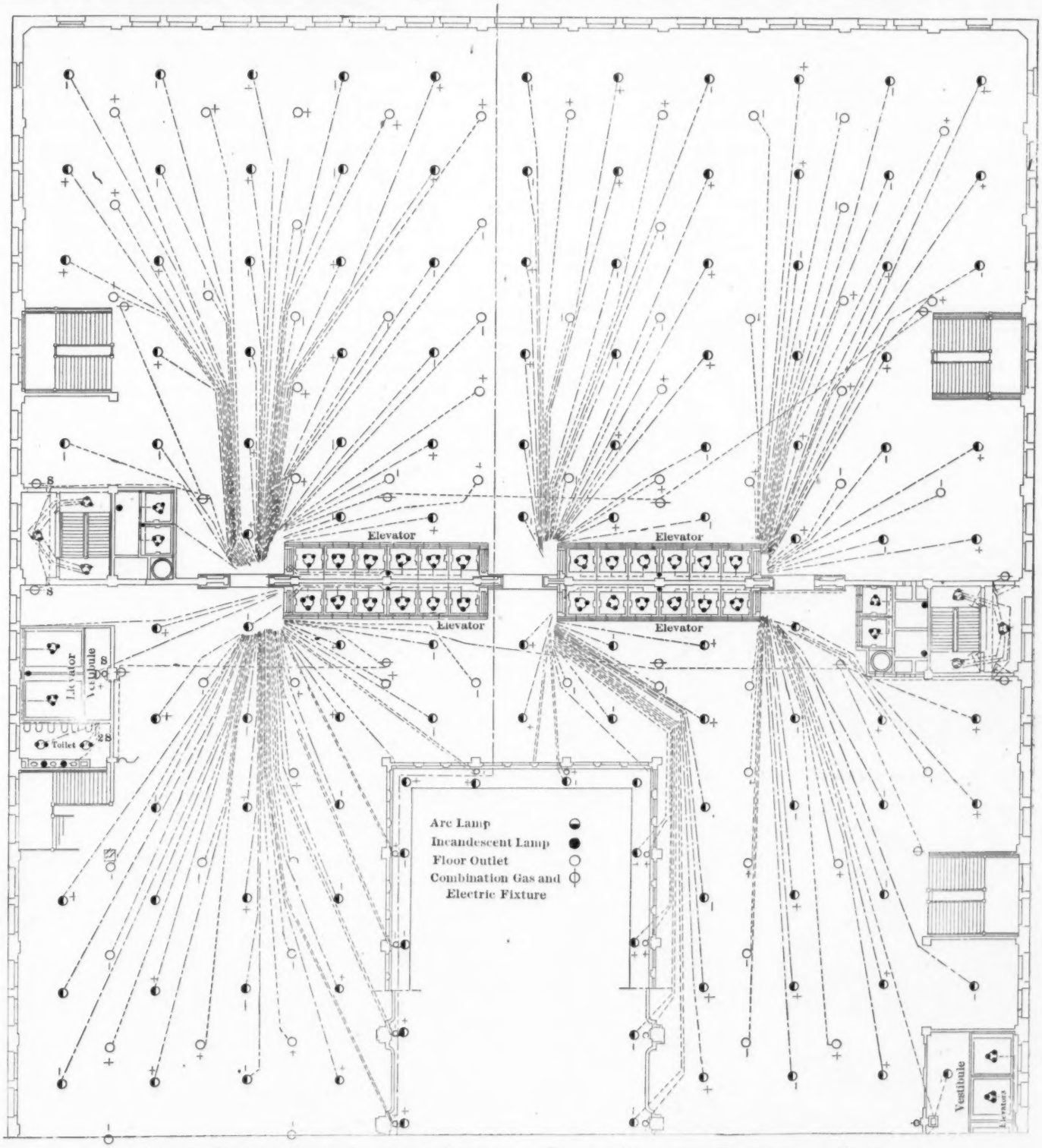


Fig. 5.—Typical Feeder Plan for One-half a Floor, Wanamaker Philadelphia Store.

are raked from beneath the fires into floor hoppers and thence into the conveyor buckets to the ash storage bin. A steel spout extends from this bin to a rack and pinion gate at the street from which the ashes are discharged into carts for removal.

The boilers are fed by four duplex feed-water pumps located on the floor below, there being two ring feed mains of 4-in. pipe, one for cold and the other for hot water, with independent 3-in. branches to each boiler. The main feed water supply is maintained in two 6,500 gal. tanks suspended beneath the boiler room floor, and these receive the drips, condensation from the with the heating mains leading to the store, so that steam is taken inductively from the system as required. The feed-pump exhausts are led directly to the heaters into which they exhaust at all times. The cold water supply is made through a 6-in. connection from the suspended tanks already mentioned, and there is also a connection from the return tanks in the basement through which the hot condensation from the heating system is raised by two submerged centrifugal pumps, each having a capacity of 200 gals. per minute.

On this floor is also the blow-off piping systems consisting

of two 2½-in. blow-off connections leading from the rear of each boiler and delivering to a 6-in. blow-off main on either side of the building which ends in a cylindrical blow-off tank, connected with the sewer. The nucleus of the high-pressure steam system is an 18-in. header located on the second mezzanine floor, into which the boilers deliver from above, and from which the engines are fed through branches taken off at the side. The second mezzanine floor is not very much higher than the level of the engine cylinders and opens outward toward the engine room so that the engine connections are easily made and do not necessitate the passing of pipes through partition walls. The engine branches are of 12-in. pipe for the large units and 8-in. pipe for the three smaller units and lead to the engines through vertical separators. In addition two 8-in. branches are carried to an auxiliary pump-room header in the basement which feeds the various pumps for the elevators and other services. There is also an auxiliary 8-in. header above the boilers in the boiler room from which the boiler feed pumps, the engines driving the induced draft fans and the refrigerating apparatus on the top flor are fed. From this auxiliary header is also taken off an 8-in. live steam line which is carried over to the store building through the tunnel. The large main steam header is sub-divided by motor-driven valves which may be controlled from the valve itself or from the switchboard on the floor below.

Fig. 6 shows the small compressor plant on the second mezzanine floor. This consists of two Clayton air compressors driven through silent chain gear by 7½-hp Crocker-Wheeler motors. The motors are automatically controlled by a Cutler-Hammer starter and speed controller, which when the tank is full cuts out the motor. When the pressure in the tank falls a predetermined amount the motors are automatically started again. The compressed air is used for cleaning purposes and also in connection with the lubricating system of the engines. Adjacent to the compressor system is an oil tank from which the lubricating oil is fed by gravity to the engines. After passing through the bearings into the flywheel pits, the oil flows by gravity to filters and thence to a receiving tank in the basement. From this receiving tank it is forced by compressed air to the storage tank on the second mezzanine floor.

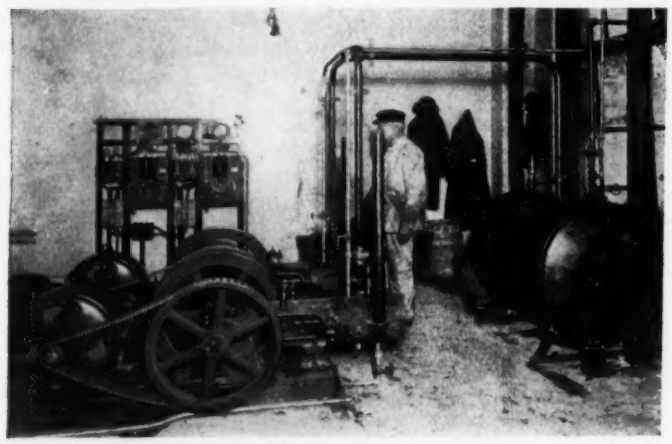


FIG. 6.—MOTOR-DRIVEN AIR COMPRESSORS.

The engine equipment consists of five vertical cross-compound Porter-Allen engines built by the Southwark Foundry & Machinery Co., of Philadelphia. Two of these are of 1,600 indicated horse-power and three of 575 indicated horse-power capacity. Each of the large engines has a maximum capacity of 2,200 hp and is direct connected to two 500-kw Crocker-Wheeler direct-current generators which it drives at 115 r.p.m. Each of the three smaller engines is designed to operate two 175-kw Crocker-Wheeler generators, one on each end of the main crank shaft, at a speed of 150 r.p.m. The maximum output of these engines is about 800 indicated horse-power. All of the engines operate non-condensing.

The generators operate on the Edison three-wire system, lamps being fed with current at a potential of 115 volts and motors at a potential of 230 volts. The electrical circuits are controlled from a switchboard in the first mezzanine gallery from which all movements in the engine room are readily observed. Copper bars supported on slab-slate insulators in a trench in the engine room and carried behind a sheet-steel shield along the wall deliver energy from the generators to the switchboard. The connections between the terminals on the generator and the proper lead are made with flexible, rubber-covered cable sweated into the terminals of the generator and fastened by lugs to the copper bars.

Views of the switchboard are given in Figs. 2 and 3, the latter showing the heavy copper bus bars and leads. The switchboard was furnished by J. F. Buchanan & Co., of Philadelphia, for whom it was built by the H. O. S. Engineering Co., of Newark, N. J. It is 47 ft. long and contains 18 panels as follows: Four 500-kw generator panels; six 175-kw generator panels; one totalizing lighting panel; one totalizing power panel; three lighting feeder panels for store distribution; two panels for power-house lights and power, and one panel for power-house mains for store distribution. The feeders from the switchboard to the north section of the store building consist of nine 2,000,000 cir. mil. cables for lights and two cables of the same size for motor circuits. The middle section of the building will be fed by twelve 2,000,000 cir. mil. cables for lights and four cables of the same size for motor circuits. The south section will have twelve 2,000,000 cir. mil. cables for lighting and two 2,000,000 cir. mil. cables for motors. These cables are all stranded, rubber and lead covered held by iron brackets and porcelain insulators and pass through vitrified underground conduit to the store building. In addition the following feeders are run in the power-house itself: One set to the north wall for lights on the first mezzanine floor, engine room, basement and tunnel; one set to the north wall for lights on the second mezzanine floor, engine room, basement and tunnel; one set to the north wall for lights on the second mezzanine floor and all floors above; one set of 10-hp capacity to motors driving the ammonia pumps in the refrigerating room; one set of 50-hp capacity for the motors driving the circulating pumps in the refrigerating room; one set of 75-hp capacity to the motor driving the coal conveyor; two sets of 100-hp capacity for motors driving the forced draft apparatus on the second mezzanine floor; one set of 10-hp capacity for motors driving the bilge pumps in the pump room; one set of 30-hp capacity for motors driving the centrifugal pumps in the pump room; one set of 20-hp capacity for motors driving the deep well pumps; two sets of 20-hp capacity to motors driving centrifugal pumps, and one set of 75-hp capacity for motors driving the house pumps. The situation of the various panel boards in use in the power-house and the number of circuits they control are as follows: Basement, 20 circuits; engine room, 22 circuits; boiler auxiliary, 6 circuits; boiler room, 10 circuits; coal storage, 6 circuits; refrigerating room, 8 circuits. The mains feeding the basement and engine room panels are of No. 0 wire encased in 1-in. conduit; the other mains are of No. 2 wire encased in ¾-in. conduit.

In each of the three sections of the store building switchboards are provided for the lighting and motor circuits. All the feeders, mains and sub-mains to the cut-out cabinets are run on the three-wire system, the cross-section of the neutral being the same as that of the outers. The motors are fed on a two-wire system. Especial attention is paid to the proper balancing of the load on all mains and feeders of the lighting system. Fourteen wire shafts are provided in which all the mains, feeders and sub-feeders supplying the various floors and sub-centers are run. The cables are secured by iron brackets and porcelain insulators securely fastened to the sides of the wire shafts. Galvanized iron turnbuckles are provided to securely anchor each feeder at centers and upper terminals. Porcelain bushings are installed where the cables pass through each floor and when the cables are drawn in place these bushings are cemented in place by Portland cement concrete not less than 6 ins. thick the full area of the wire shafts, thereby forming closets of these shafts on each floor.

A set of mains runs from each switch on the lighting switchboard to a load center in its respective wire shaft. From load centers a set of feeder risers supply energy to cut-out cabinets on each floor. From a cabinet for combination gas and electric light fixtures located near the tunnel entrance, a set of mains is run to a load center in the wire shaft nearest the center of the North section, and from this load center a set of feeder risers supplies energy to cut-outs controlling all gas and electric light fixtures in the North section of the building. In a similar manner two sets of feeders will be run in two shafts supplying all the combination gas and electric light fixtures in the Central section of the building and one set will feed the Southern section.

The building is wired for 16-cp incandescent lamps and 6-amp. 110-volt enclosed arc lamps. Each arc lamp is provided with a separate circuit and all vestibule and corridor lamps around the elevators are fed from a separate circuit from the surrounding lamps on the same floor. All circuits from cut-outs and cabinets are alternately positive and negative on the same side, instead of all positive circuits being on one side and all negative circuits on the other, so that the system will be well balanced. All lamps in the pipe, elevator and vent shafts are wired on separate circuits controlled from the cut-out cabinets in the sub-basement. Fig. 5 shows the arrangement of lamps and circuits on one half of a floor, the other half section being identical. The engraving also shows the situation of the wire shafts on either side of the fireproof partition wall separating the sections of the building. Owing to the fact that the portion of the building now in use ends at the shaft near the center, the portion beyond now being in process of construction, this wiring shaft could not be used, so that all feeders in the portion in use are fed through the two shafts in that section as shown.

No wire smaller than No. 14 is in use and all wire larger than No. 10 is stranded. The floor outlets terminate in watertight receptacles fitted with adjustable tops which set flush with the finished floor. From Fig. 5 it will be evident that each floor is plentifully supplied with floor outlets. All wires except the cables in the wire shafts, are run in conduit from the cut-out cabinet in each wire shaft on every floor. All of the outlets shown are for 12 incandescent lamps, although there are outlets for 25 lamps and others for 60 lamps. An elaborate system of conduit for low potential circuits is also installed on each floor for telephone, fire alarm, bell circuits, etc. The outlet boxes are all connected to the wire shafts so that after the instruments are located they may be readily connected to the nearest outlet box. This system is similar to the one in use in the New York store of John Wanamaker described in these pages last week. The total number of connected arc lamps will be 2,874, and the total number of incandescent lamps 12,251, 2,740 of which are used in the windows. About 40 motors are connected with an approximate horse-power of 900. There are in all 68 hydraulic elevators, 52 of which are for passengers, and in addition 10 electric dumbwaiters.

The architects and engineers for the power-house and store building are D. H. Burnham & Co., of Chicago, and it is to their superintendent, Mr. P. G. Chase, that we are indebted for information contained in this article.

The Survival of the British Electrical Manufacturer.

By R. A. Brown.

The directors and shareholders of electrical manufacturing companies domiciled in Great Britain have been taking very serious interest in the first parliamentary election for over half a century in which "Free Trade" has been called in question. The electrical industry has suffered somewhat cruelly from unrestricted foreign competition, not so much in respect of the actual volume of business secured by American, German and other manufacturers, which appears to have amounted to about £2,000,000 per annum, as of the depressing influence on prices. It is clear that competition has been much intensified by the free entry of foreign goods, so that the two largest works in England, which have a good deal of American capital in them, are both unable to pay dividends, with all their special advantages in having the technical and commercial assistance of their parent concerns in the United States.

When we reflect upon the succession of misfortunes which have in the past made electrical manufacturing not merely hazardous but apparently hopeless as a permanent industry in Great Britain, it is most interesting to observe in what courageous manner old-established firms have kept up a dogged struggle against the difficulties of the situation. If we take, for example, the oldest of them, the Brush Electrical Engineering Company, there are features in its history which are a remarkable testimonial to the endurance and adroitness of the British business man. In the first place, when the Brush Company was founded, and began to look around for business, the British legislature closed the market effectually by passing a ridiculous Electric Lighting Act in 1882, which made it impossible for companies to supply electricity with any hope of financial success; and it was not until six years later that a more tolerant act was passed which made electric lighting commercially feasible. In those six years, British makers of electrical apparatus had to pick up a bare living as best they could, while American and German concerns were going ahead and getting a long lead; so that when business did begin to boom in England the foreigners were much better able to compete for it than the stunted and starved British manufacturers. All British electrical legislation was conceived in the interests of the municipalities that were slow to move, and consequently the country was much behindhand in electric traction as well as supply; and when tramways at last came to be constructed the Americans reaped a rich harvest.

Still the British firms managed to live. The Brush Company, for instance, made a really heroic effort, and in a year or two actually gained a notable position as the largest builder of electric rolling stock. Whereas, at first, nothing but American trucks were used on British street railways, the position is now reversed, and the Brush Company supplies about three-quarters of all the trucks in service. Supported by a prosperous rolling stock department, the Brush Company was then able to nurse and stimulate the growth of its electrical manufactures, and during the past three years has been greatly extending its business in generating plant, motors, transformers, etc. It has evolved a type of the Parsons turbine possessing some remarkable features, giving exceptional efficiency, and at the same time has gained a leading reputation for its reciprocating engines. The British Electric Traction Company, which controls about sixty traction and supply undertakings, has become invested largely in Brush shares, and purchases its requirements from that concern, so that the company is at present in a more flourishing condition than for many years past, and is at this moment making considerable additions to its premises and plant to cope with greatly increased business.

If a slight measure of protection were introduced by the British Parliament—and many shrewd political prophets believe that this will happen during the next five years—the Brush Company would receive a further stimulus, and there is no doubt that its prolonged but victorious struggle against overwhelming odds has developed a splendid fighting spirit in its directors and chief officials, whom necessity has compelled to exercise constantly ingenuity and vigilance.

Of course there are other examples of the "survival of the fittest," and among the British companies that by dint of sheer grit and power of endurance have managed to hang on and to grow may be mentioned such standard "old-timers" as Crompton & Co., Ltd., of Chelmsford, and the Electric Construction Company, of Wolverhampton, England. In addition to these specimens of well-seasoned "hearts of oak" are one or two other concerns of lesser magnitude, but equal toughness that have come safely through years of "battle and breeze." Amid the crop of new covers they are likely to be overlooked and forgotten, even here in England where we relish and favor so much anything that has a touch of antiquity about it; but the mere fact that they have endured is to their credit, and the point is now made on their behalf.

Hopkinson Test of Two-Phase Alternators.

In testing a large generator it is frequently inconvenient to supply to it the necessary mechanical power to correspond to its full-load rating or to dissipate the electrical power which the machine delivers under these conditions. Even where it is possible to obtain the required mechanical power, it is often extremely difficult to adjust the electrical load both with regard to its value and its power factor. Due to these facts recourse is frequently had to certain no-load tests made on the machine, from which the performance is determined.

For determining the performance of a generator the most familiar method is the one involving the use of the open-circuit and the short-circuit characteristics. The former characteristic is observed by noting the voltage generated in the armature at full speed for various values of the exciting current, the armature being on open circuit. The short-circuit characteristic is found by driving the rotor at full speed and observing the current in the armature on short-circuit as the field strength is varied. From these two sets of observations may be determined the synchronism impedance of the armature, and when the resistance of the armature circuit is known the electrical behavior under assumed loads can be determined with a fair accuracy.

The curves of Fig. 2 represent the open-circuit and short-circuit characteristics of a Siemens two-phase alternator built for the Johannesburg (South Africa) Municipality. This generator is rated at 3,300 volts and 275 amperes per phase, and, hence is a 1,800-kv.a. machine. It is intended to operate at a normal power factor of .75 and is designed for 1,350 kw. Its normal speed is 100 r.p.m., and being provided with 60 poles it delivers current at 50 cycles per second. There are 480 slots—four per pole per phase. The diameter of the stator core is 260 in. (660.4 cm.), and length 10 in. (25.4 cm.), there being no ventilation ducts. The air gap is 6.6 mm.

The specifications required that the rise in voltage on throwing off the full load at unity power factor and 3,300 volts should not exceed 5 per cent, and that the fall in voltage on throwing

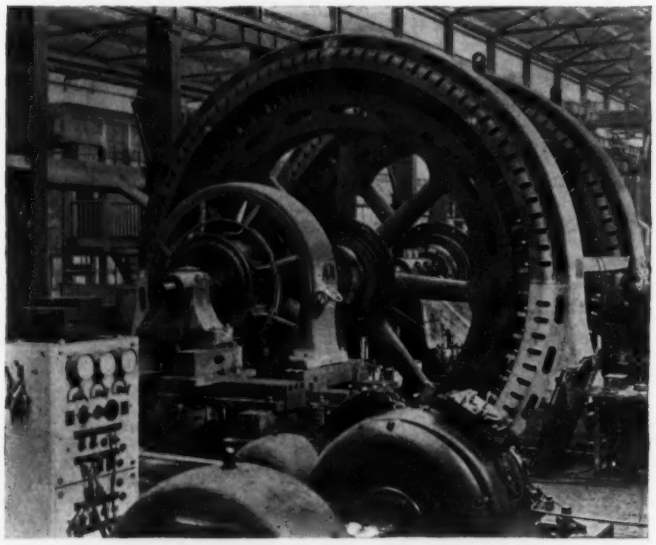


FIG. 1.—1,350-KW, TWO-PHASE ALTERNATOR.

on full load at unity power factor and 3,100 volts should not exceed 6 per cent. It was specified that at full load with 75 per cent power-factor the excitation power at 230 volts should not exceed 20 kw. The no-load characteristics permit one to ascertain to what extent these requirements have been met, and by their use it is possible to determine the efficiency with sufficient exactness for all practical requirements. They are incomplete in one respect, however, in that they give no clue as to the probable temperature rise in the machine under load conditions.

For the purpose of ascertaining the temperature rise under various loads at different power-factors, two of these machines were connected together both mechanically and electrically and subjected to a Hopkinson "loading-back" test, a direct-current motor being used to supply the losses mechanically to the two machines. With the rotors joined directly together, the two frames were angularly shifted from their normal positions so as to cause the circulation of power between the two machines, the proper value of current at normal full load being obtained when

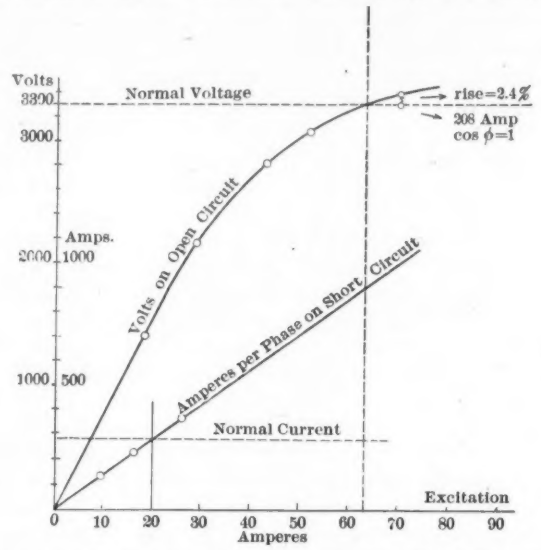


FIG. 2.—OPEN-CIRCUIT AND SHORT-CIRCUIT CHARACTERISTICS (TEST RESULTS).

there was a mechanical displacement corresponding to 25 electrical degrees—somewhat less than one mechanical degree.

The leading machine operated as a generator under actual working conditions with 1,350-kw, 205 amperes, and $cos\ \phi = 1$. while the lagging machine ran as a motor with slightly reduced flux. Without changing the mechanical displacement of the stators it was possible to operate the generator at normal full-load current (273 amp.) at $cos\ \phi = .75$ simply by giving the two machines different excitations. As was to be expected, the current circulating between the two armatures was absolutely steady, showing no signs of hunting or surging.

From the readings of the input to the direct-current generator and a knowledge of its internal losses, it was determined that the losses of one alternator amount to 93 kw at an output of 1,377 kw, giving an efficiency of 93.6 per cent at unity power-factor.

We have been informed that if a temperature rise of 70° F. had been allowed these machines could have been rated at 2,400 k.v.a., but they have been given the lower rating on account of the fact that the specifications limited the temperature rise to 50° F. under full load at unity power-factor.

Leads for Alternating-Current Machines.

The accompanying illustrations show a method for placing the high-resistance leads in the armature core of an alternating-current commutator motor, as disclosed in a patent issued March

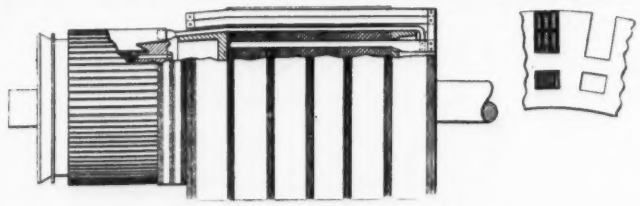


DIAGRAM OF RESISTANCE LEADS.

27 to C. P. Steinmetz. The resistance leads are placed in a second set of slots more remote from the periphery than the slots carrying the main armature conductors, so that the heat produced in the leads is conducted away by the armature core without affecting the main armature conductors. The leads are bifilar, so that they are non-inductive and the effect of all induced e.m.f's is avoided. The leads are connected to the armature coils at the end opposite from the commutator in order that they may be readily accessible for repairs.

The Niagara-Syracuse Transmission Line.

By Orrin E. Dunlap.

THE greatest power transmission line this side of the Rocky Mountains is being built between the Niagara border and the city of Syracuse by the Niagara, Lockport & Ontario Power Company, its length being about 160 miles. While the line has the above-mentioned length in New York State, there are also about four miles of towers and cables on the Canadian side of the river, for it is contemplated that power generated on the Canadian side shall supply the line. According to report, considerable of this transmitted Canadian Niagara energy is to be applied to the operation of present steam railroads in the western New York section, which are to be electrified. This includes portions of the New York Central and the old West Shore between the Niagara border and Syracuse, while electric roads in the cities referred to will be able to obtain power from the line if they so desire. In the map shown below transformer stations are indicated by the circles, transmission lines by the solid lines, and extensions by the broken lines.

The power house in which the electric current for transmission is to be generated is that of the Ontario Power Company. As this plant has been fully described in these pages, a mere résumé here is sufficient. It is located at the water's edge in the Niagara gorge right below where famous old Table Rock used to stand. The debris slope of the river bank has been cleared away to make room for the power station, which is a concrete building that stands very close to the foot of the Horseshoe Fall. There is no other building so close to the falling waters as they plunge

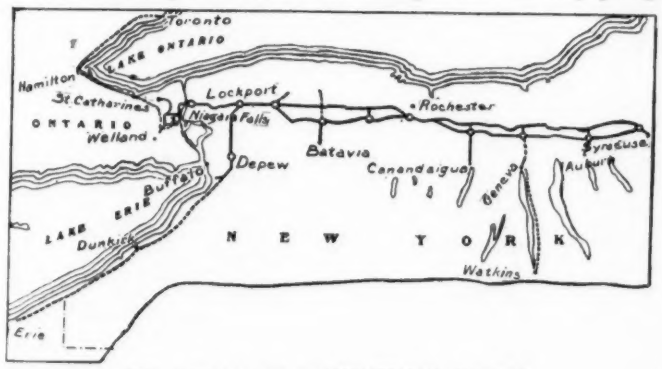


FIG. 1.—MAP OF TRANSMISSION SYSTEM.

from the higher to the lower level, and as the demand for power increases it is the company's intention to enlarge the power house and its equipment.

The Ontario Power Company adopted a plan very similar to that of the Niagara Falls Hydraulic Power & Mfg. Company, the oldest power company on the New York side of the river, but instead of building a surface canal it built a great steel flume to carry the water from the forebays to the spillway over the power house. The company erected a great wing dam that diverted the water from a large area of the riverbed above the Horseshoe, and in this unwatered section it built its forebays, the intake works being located at the head of Dufferin Islands, at a deep indenture in the shore. The outer forebay has an area of eight acres, and the inner forebay an area of two acres. These ten acres of forebay area lie in the normal bed of the river, a concrete wall surrounding the outside. Considerable of the limestone riverbed had to be blasted away to give the required depth of water. The outer forebay is long and tapering and terminates at the lower end in a spillway enclosed on the river side by a submerged wall, while opposite the spillway is a screen house leading to the inner forebay. The gatehouse is located at the lower end of the inner forebay, and here electrically-operated Stoney headgates are located. The depth of water is 30 ft., and it is at this point that the big steel flume obtains its water supply.

No other feature of the power development at Niagara commanded quite so much attention as the big flume of this company. It is made of ½-in. riveted and reinforced steel, has a diameter of 18 ft. inside measurement, is 6,500 ft. long, and is sheeted with concrete. In order that it may not disfigure the park lands, a trench was excavated through the rock and soil of Victoria Park and the conduit buried from sight. The velocity of the water in the conduit is about 15 ft. per second. Each pipe of this kind is expected to deliver 3,900 cu. ft. of water per second, or enough to develop 60,000 electrical hp. At its end on the cliff above the power house the present flume turns into an outer relief or spillway, and it is here that the penstocks are connected.

Eight penstocks will connect with each big flume, and six of

FIG. 2.—ALUMINUM TRANSMISSION LINE ACROSS NIAGARA GORGE.

these penstocks, or three pairs, will have a diameter of 9 ft. and carry water to the wheels of six main generators. Before delivering its water to the wheels in the power station each of the 9-ft. penstocks divides into two branches, one for each wheel. There are also two smaller penstocks that deliver water to the wheels of the exciters. Twin turbine wheels mounted on horizontal shafts are direct-connected to the 10,000-hp generators installed in the station. Three generators have already been installed by the Westinghouse Company, and the fourth is now being erected. In passing from the spillway to the power house the penstocks run through tunnels driven through the cliff, in order that their presence may not mar the scenic spectacle at the face of the cliff. The power generated in the station will pass over concealed cables to a distributing station located on the bluff outside of Victoria Park, the distance back of the power house being 550 ft., while the height is 250 ft.

In all agreements made between power companies and the commissioners of Victoria Park, it is specified that all of the power developed must be transmitted outside of the park boundaries for use and application, the agreements permitting the transmis-

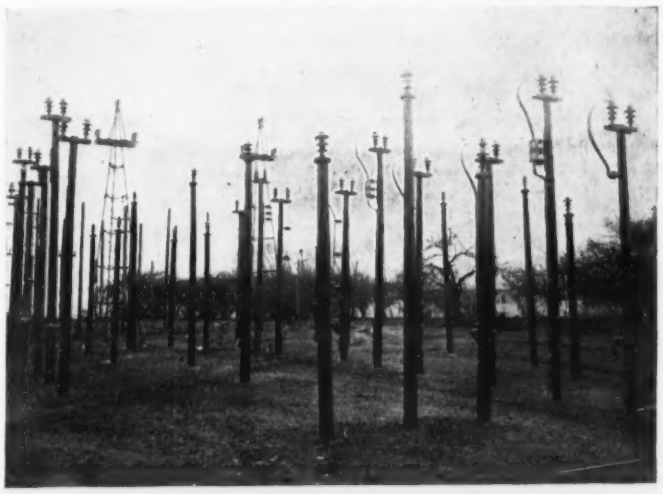


FIG. 3.—NEAR TRANSFORMER HOUSE, NIAGARA FALLS.

sion of at least one-half of the power developed to be transmitted to the United States, but on demand one-half must be available for use in Canada at prices similar to those charged for the same power in the United States for similar uses. The Governments of the United States and the Dominion of Canada do not

place an import or an export duty on electrically generated power.

From the distributing station on the bluff to the rear of Victoria Park a line of steel towers extends northward, a short distance back from the river, to a point four miles down the gorge, where the transmission line crosses the river. At the edge of the Canadian bank the cables, which are of aluminum, drop to

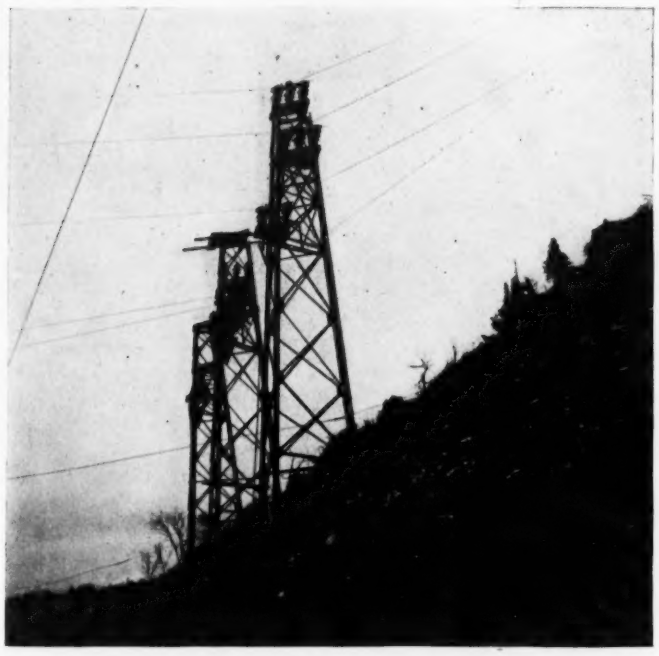


FIG. 4.—STEEL TOWERS ON NEW YORK SIDE.

cantilever arms projecting over the edge of the bank. There are nine cables, each having 19 strands of No. 5 wire, and from the cantilever arms the cables drop to steel towers erected close to the water's edge. From these towers they swing over the river, the span being about 600 ft., to similar towers erected on the New York shore. Then they pass up the bank to cantilever arms at the top of the cliff on the New York side, and then to poles and steel towers.

From this point eastward to Lockport the right of way of the power transmission line is 300 ft. wide, and there is a double set of steel towers. From Lockport to Rochester the right of way has a width of 200 ft., and between Rochester and Syracuse the permanent right of way will be 100 ft. wide. Steel towers will carry the cables as far as Rochester, and from there to Syracuse wooden frames made in the shape of the letter A will support them, temporarily along the West Shore Railroad right of way. There will be about 1,500 steel towers and 2,500 A frames. The steel towers have a height of 55 ft., and at a height of 45 ft. there is an arm. Insulators are placed at each end of the arm and at the apex of the tower, each insulator being about 28 in. high and weighing about 75 lb. The insulators are the largest used in a Niagara transmission, and have two petticoats and a hood, the latter having a diameter of about 14 in. The steel towers are set 550 ft. apart, but the A frames will be placed 220 ft. apart. The height of the wooden frames is 49 ft.

Transformer stations will be erected at various points along the line. One will be located on the river bank on the New York side, where the transmision line crosses the gorge, and another will be in Lockport. These two stations will take care of the local distribution at the points referred to. It is expected that the transmission will be made at a voltage of 60,000 right from the distributing station on the bluff over the power house. From Lockport a branch transmission line has been built to Depew and the South Buffalo district, the right of way being 200 ft. wide, and the towers having four legs, whereas the towers between Niagara Falls and Lockport have but three legs.

In running through western New York this transmission line is being built south of one set of towns and cities and north of another section, so that it will be possible by running short branch lines to give an excellent service in either direction. The power will be applied to the operation of trolley lines, of industrial plants and for lighting purposes where needed. Between Lockport and Rochester there are many thriving places like Gasport, Middleport, Medina, Albion, Holley, Spencerport, etc., which will welcome the advent of Niagara power to their sections. It is expected that the transmission line will be ready to deliver its current some time during the coming summer, as the power house is now ready to supply the line, and the big distributing station is having its transformer equipment placed in position.

There is so much talk about the electrification of the steam railroads of New York State that the enterprise shown in the construction of this transmission line far into the interior of the State must be looked upon as possibly a part of the project of electrification. When in operation it will be the longest power transmission in the East, and its operation during the various seasons will interest engineers to a considerable extent, as it is well known that the longer transmissions in the West have advantages in climate and weather not possessed by this Eastern work. Up to this time the longest transmission of any great amount of power from Niagara is to the city of Buffalo, the distance being about 25 miles, so that carrying Niagara power to Syracuse, about 160 miles away from the generating station, will be quite a different accomplishment.

Proposed Niagara Power Transmission Lines.

In considering the future transmission of electric power generated in the new generating stations at Niagara, it is interesting to note that the Niagara Falls Electrical Transmission Company

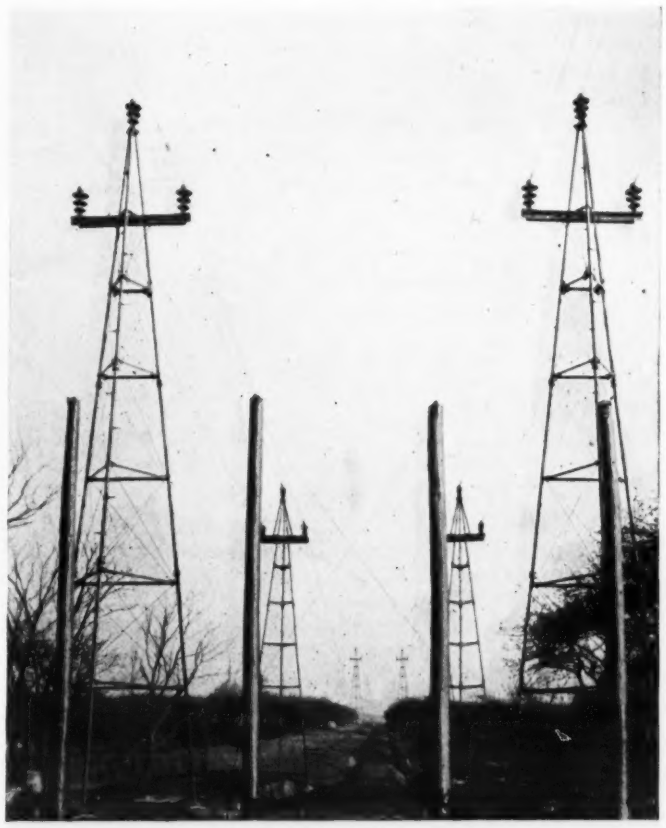


FIG. 5.—GENERAL VIEW OF TRANSMISSION LINE.

has just been granted authority by the State Gas and Electricity Commission to increase its capital stock from $100,000 to $5,000,000, and also permission to purchase the obligations of the Albion Power Company and the stock and obligations of the Niagara Falls Gas & Electric Light Company. By the contemplated purchase of the Albion and Niagara Falls companies referred to valuable franchise rights will be obtained. The Niagara Falls

Electrical Transmission Company is a project backed by the Hon. Frank A. Dudley, of Niagara Falls, who is vice-president of the company, with Frederic Nicholls, of Toronto, Ont., as president. This company will act as the distributing agents in New York State for power developed in the plant of the Electrical Development Company, of Ontario, Limited, on the Canadian side of the river. So far as its plans are announced, the company's main transmission line will, if the franchises are allowed, cross the Niagara gorge on a new bridge to be erected by the Trans-Niagara Bridge Company at a point about 300 ft. below the present upper steel arch bridge, the new bridge to be wholly devoted to electric railway and power cable services across the gorge. From Niagara Falls, N. Y., the main transmission line of the transmission company will run to Tonawanda, where it will branch off, one branch going toward Buffalo, the other toward the interior of the State, where it may ultimately be the feeder for the proposed trolley line between Rochester and Niagara Falls, a $2,000,000 contract for which, it is reported, has just been awarded to the Transit Construction Company of New York.

It will be seen that all of the power to be transmitted into New York State by these companies is to be generated in stations located on the Canadian side at Niagara. In the agreements between the various power companies and the commissioners of Victoria Park the following provision exists:

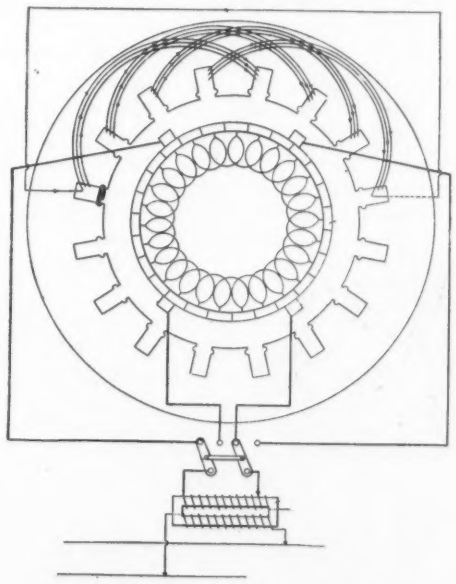
"The company whenever required shall from the electricity or pneumatic power generated under this agreement, supply the same in Canada to the extent of any quantity not less than one-half the quantity generated at prices not to exceed the prices charged to cities, towns and consumers in the United States at similar distances from the Falls of Niagara for equal amounts of power and for similar uses, and shall, whenever required by the Lieut.-Governor in Council, make a return of prices charged for such electricity or power verified under oath by any chief officer of the company, and if any question in dispute arises involving the non-supply or prices of electricity or power for consumption in Canada, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged."

This agreement was approved by the Ontario Government, but when it comes to the exportation of power from Canada to the United States the matter is one under federal control, and it would appear from a bill recently introduced in the House of Commons at Ottawa, Ont., that at least one of the companies generating electricity on the Canadian side does not feel that it is authorized under the agreement to export power, and for this reason the bill was introduced whereby the Dominion ratifies and confirms the agreement, as it is understood that a high constitutional authority has said the legislation making the exportation of Canadian power possible cannot be included in a private bill. Legislators in Ontario and the Dominion Governments are giving a vast amount of attention to the question of the exportation of Niagara power, and it is not yet clear what the exact future position of the provincial and federal governments is to be on the subejct. At this writing, it may be assumed from the utterances of public men in Canada, that the position of the Dominion will be to have it understood that any permission given for the exportation of power will be revocable on short notice, as it is evident that Canadians are not yet prepared to utilize all of the power under development at Canadian Niagara.

In addition to the power that is to be brought to the American side of the Niagara River by the Niagara, Lockport & Ontario Power Company and the Niagara Falls Electrical Transmission Company, the Canadian Niagara Power Company, allied to the Niagara Falls Power Company, has had its power house on the Canadian side connected by cables with the two big power houses of the Niagara Falls Power Company on the New York side, and the new Canadian station can be operated in parallel with either or both of the stations referred to. The Canadian Niagara Power Company is also about to erect a power transmission line along the Canadian side of the river from the falls to Fort Erie, where the cables will cross high over the river to Buffalo, the Cataract Power & Conduit Company of Buffalo having planned a fine new station on the river front in Buffalo for the reception of power from the falls. It will thus be seen that while the power development on both sides of the river at Niagara is destined to be very extensive under present franchises, the transmission lines contemplate distributing the energy so that a wide section of territory will be benefited, for the transmission line of the Toronto & Niagara Power Company, the Canadian distributing agent of the Electrical Development Company of Ontario, Limited, will extend to Toronto, Ont., affording that city and the intervening places every facility to enjoy the transmitted energy of Niagara.

Series Induction Motor.

In a patent issued March 20 to A. S. McAllister a description is given of a motor which is stated to possess the characteristics of a compensated single-phase motor and to operate at a high power factor. As shown in the accompanying illustration, the line connecting the brushes makes a certain angle with the axial line of the field magnet coils. The current which enters the armature winding causes the formation of magnetic poles upon the armature core, and the alternation in these poles generates an electromotive force in the field coils. The current thus produced in the field coils causes the formation of magnetic poles in the stationary field cores. The armature current which flows in the neighborhood of the field poles thus produced gives to the rotor a torque in much the same way as with direct-current series motors. When the rotor is in motion there is generated at the commutator a counter e.m.f. which weakens the effective e.m.f.,



M'ALLISTER SERIES INDUCTION MOTOR.

and therewith the armature current, the armature core magnetism, the field current and the field core magnetism. The generated counter e.m.f. is practically in phase with the current supplied, and therefore it acts as the insertion in the circuit of a resistance which varies with the speed. At negative speed the inserted apparent resistance is negative, and at a certain value of negative speed the total apparent resistance of the motor circuit is zero At higher negative speeds the total apparent resistance becomes negative, the interpretation of which is that the machine is now being operated as a generator and is supplying power to the line. The machine, therefore, may operate as either a motor or a generator. If during operation as a motor at a certain speed the connections to the rotor be so changed as to tend to drive the rotor in the opposite direction, not only will a braking effort be produced by such change, but power will be transmitted from the machine to the line. Two sets of brushes are employed, located at different angles with respect to the field coils, only one set of which is used at a given instant, in order to convert the motor to a generator so as to bring the rotor to rest.

Electric Locomotive for the New York, New Haven & Hartford Railroad.

Our issues for March 24 and 31 contained abstracts of a paper by Mr. B. G. Lamme giving an outline of the plans of the New York, New Haven & Hartford Railroad Company in connection with the electrification of a portion of its main line and describing briefly the electrical equipment. We are able to give below a few more details relating specifically to the electric locomotive. Numerous interesting features relating to the motors are not, however, available for publication at the present time.

Each of the four motors used with the locomotive is of the conductively compensated type, the field winding being arranged in two circuits: the main field coils and the compensating field coils. The compensating coils are connected permanently in series with the armature and serve to neutralize the reactance of the armature circuit and thus to increase the operating power factor.

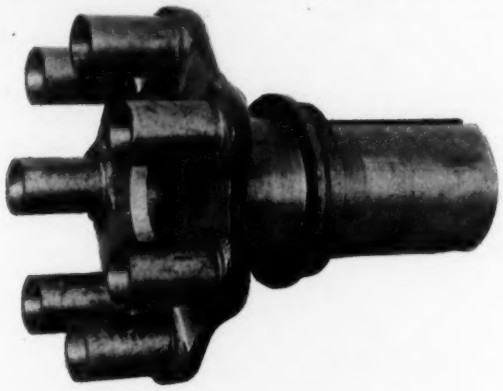


FIG. 1.—ONE OF THE DRIVING QUILLS.

The active armature winding is one of the well-known direct-current types. However, the winding is closed on itself and is not directly connected to the commutator, but is indirectly connected to it through preventive leads of low conductivity material. These leads serve the same function as the well-known preventive coils used in alternating-current work when passing from one tap to another of a transformer. In fact, this armature, in one sense, may be considered as a transformer with a lead brought out from each coil to a contact piece, the various contact pieces being assembled together to form a commutator. The brush, in passing from one contact to another, short-circuits an intermediate coil, just as in the case of a transformer under similar conditions. The size and capacity of the preventive coils or leads in a motor are such that under continuous operation they will attain the same temperature as the active winding.

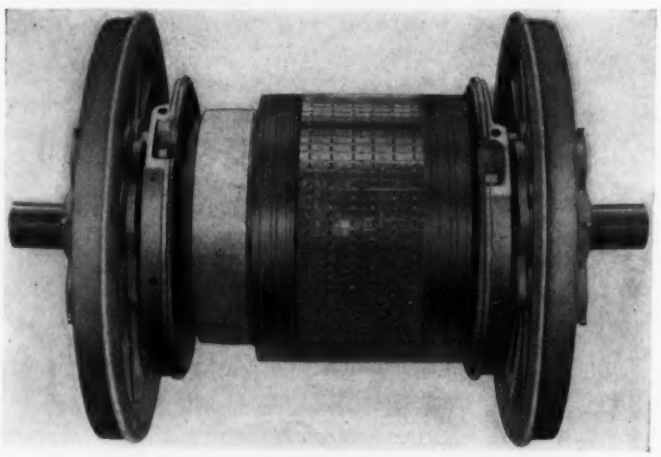


FIG. 3.—ARMATURE AND DRIVING QUILLS ON LOCOMOTIVE AXLE.

The function of the preventive coils or leads is to reduce the short-circuit, when passing from one commutator bar to the next, to a rather low value. For reducing the loss, due to this source, to the lowest possible value, the preventive action in the leads should be as high as possible. However, as the working current supplied to the motor must pass through the same leads, it is evident that for best results the preventive action, as regards the working current, should be as low as possible. It is, therefore, evident that there is some intermediate condition which gives the most efficient results, both as regards economy of power and commutation of the current. The preventive leads on these motors have been proportioned for this condition. Thus the losses are actually less when the preventive leads are used than when they are omitted, and the commutation is correspondingly better, especially at low speed and at start. Without these leads excessive current will be found, especially at start, this being indicated by glowing and spitting at the tips of the brushes. This action appears to be practically absent in the New Haven motors.

The active armature winding consists of several coils per slot, with one turn per coil. The coils are made of form-wound strap and are inserted in the slots from the top. Fibre wedges are used for holding the coils in place in the body of the armature, while binding wires serve for supporting the ends of the winding.

FIG. 2.—MOTOR ARMATURE UNMOUNTED.

The commutator is so constructed and insulated that it wears evenly over the faces of the bars, and there is no tendency to form "high mica." In consequence the commutator takes a good polish and presents a smooth, glossy surface to the brushes. The very slight wear of the brushes indicates that commutating conditions are very good, and the commutators themselves remain in first-class condition. The total locomotive mileage is not yet sufficient to determine the life of the brushes, except by approximation from the present rate of wear, and this has been so small that an accurate estimate cannot yet be made.

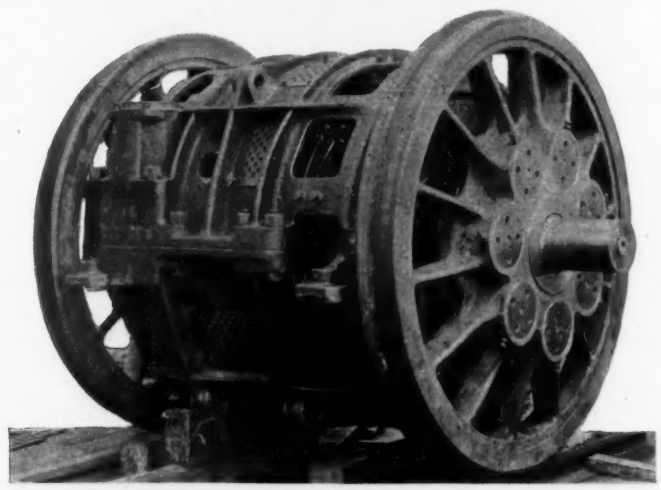


FIG. 4.—MOTOR COMPLETE, SHOWING OUTER FRAME WITH PERFORATIONS.

There are several brushes per holder, and both the brushes and holders resemble closely those used in direct-current work. The brushes have a thickness of ½ in. and are pressed against the commutator by means of a coiled spring. A flexible copper jumper or shunt is used for carrying the current to the brush.

The major insulation, between the holder and the framework of the motor, is mica in the form of tubes which fit snugly over studs which are riveted to the body of the holder. Over each mica tube is placed a short porcelain sleeve and a long metallic cartridge. A clamp serves for squeezing the cartridge tightly against the mica tube and for retaining the brush holder in place on the framework of the motor. The porcelain sleeve furnishes a certain amount of mechanical protection to the mica tube, and it aids in insulating the holder from the frame, but its mechanical strength is not utilized in connecting the holder to the frame.

The hollow shaft of the armature is built up in two parts, one of which is shown in Fig. 1. Each part is provided with an end disc from which project seven pins. One of the parts is forced by hydraulic pressure into the commutator end of the hollow armature spider (Fig. 2) and securely keyed in place, while the other is similarly inserted in the opposite end. Fig. 1 shows the position of the bearing surface on the armature shaft mentioned above, and also the hollow projecting pins, the function of which is discussed below. The mounting of the armature and quills on the locomotive axle is indicated in Fig. 3. The discs shown at the two ends of the armature in this illustration are at-

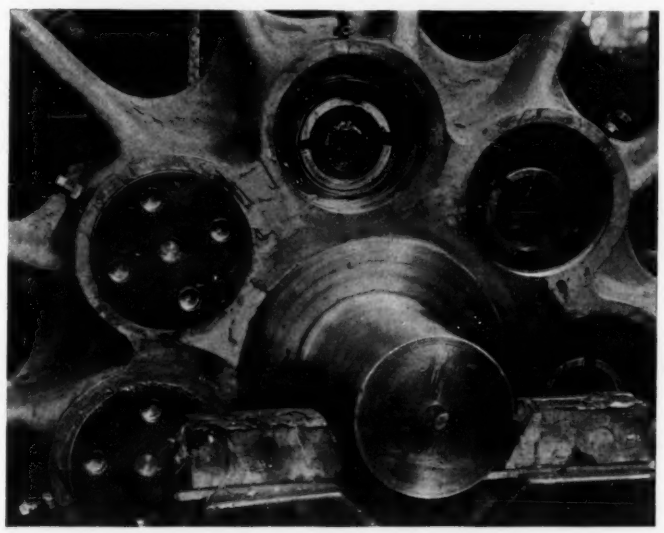


FIG. 5.—DETAILS OF POCKETS IN DRIVER.

tached to the outer sections of the bearings on the quills and to them is rigidly clamped the outer field frame of the motor as represented in Fig. 4.

Mechanically considered the motors are of the gearless type, and interest in the equipment is naturally centered in the methods employed for suspending the motors and for transmitting the torque to the drivers. Special precautions are taken to insure that both the gravitational force of the motor on the axle and the torsional force of the armature on the drivers are transmitted through elastic mediums, in order to minimize the effect which the great weight of the motor equipment would produce at the high speeds. The field structure of each motor is mechanically connected to its armature structure through two bearings, which insure that the armature will remain at all times concentric to the field poles. The weight of the motor, therefore, may be carried by the armature shaft or by the field structure, according to the relative values of the upward pressures exerted on these members. Through the hollow portion of the shaft of the armature passes the axle of the locomotive with a clearance of about 5/8 in. on all sides. On each end the locomotive axle is mounted on a 62-in. driving wheel, in the hub of which are formed seven circular pockets, which contain helical springs for assisting in carrying the weight of the motor and for transmitting the torque from the armature.

Separate means are employed for carrying the weight of the motor and for resisting the backward torque of the field structure against the truck. A steel frame entirely distinct from the truck is pivoted from the journal boxes of each locomotive axle, and from this frame the weight of the motor is carried by springs on which rest lugs of the field structure. The adjustment of the tension on these springs determines what portion of the weight of the motor is carried by them and just how much weight is carried through the pins on the armature quill.

In connection with the pulsating torque of the single-phase series motor, it is especially noteworthy that while the torque of the machine pulsates at twice the circuit frequency and the electrical torque varies from its maximum value to zero and even assumes a reversed value if the field flux is not in time phase with the armature current, such condition does not exist with reference to the mechanical torque which reaches the drivers. The pulsation in the value of this latter torque depends upon the inertia of the matter which may be moved by the electrical torque before the mechanical torque produces motion, and upon the elasticity of the medium which permits the movement. Thus with the locomotive in question, when the drivers are stationary each mechanical position which the field and armature structures of the motor assume causes to be transmitted through the springs to the drivers a certain definite value of mechanical torque. In order for the mechanical torque to reach zero 50 times per second, it would be necessary for the field and armature structures to be returned by the springs to the zero torque position an equal number of times in this period. The final result is that, unless the inertia of the moving mass and the elasticity of the springs happens to be adjusted for vibrational resonance at the circuit frequency, the armature and field structures will vibrate through very narrow limits and the torque which reaches the drivers will fluctuate in unison therewith, but will be almost constant at a value equal to about one-half of the maximum electrical torque. Observations have shown that the mechanical torque exerted by the locomotive drivers varies only slightly, although the torque of the motors as found under brake tests fluctuates through a considerable range.

The two armatures on each truck with their corresponding compensating field coils are joined permanently in series, and are operated at all times as a unit. For direct-current work the two motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating-current work the two units are operated separately from the secondaries of the step-down transformers at variable voltage, so that they are practically joined in parallel at all times. During alternating-current operation each motor unit is fed at variable voltage from the secondary of a step-down transformer, there being two separate and distinct transformers on each locomotive. There were three objects in using two rather than one main transformer: one relates to the convenient disposal of the weight of the transformer on the locomotive; the second to the increased reliability of service in case a transformer circuit should be disabled, while the third has reference to the convenient arrangement and employment of the same unit switches for either direct-current or

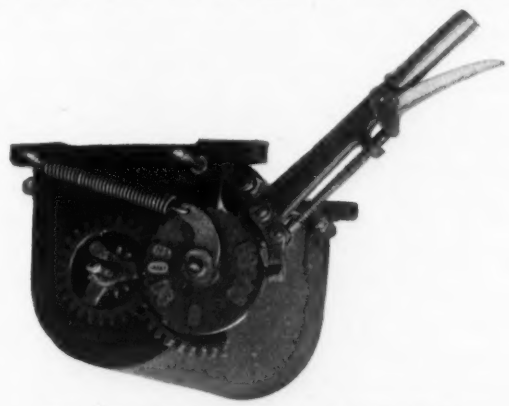


FIG. 6.—TOP VIEW OF MASTER CONTROLLER.

alternating-current work. The same master controllers are used for alternating current as for direct current. At each running point the motor circuits are joined directly to a certain tap on the transformer winding and no extra resistance is in circuit. In passing from one tap to one next higher in voltage a resistance is first inserted between the taps, then the connection to the lower voltage tap is broken, thereby placing the resistance in series with the motor at the higher voltage; then the resistance is short-circuited, leaving the motor joined directly to the higher

voltage tap. The "preventive resistance" used between the taps is exactly the same resistance unit used at a certain step in the direct-current control, while the same short-circuiting switch is used in each case.

Each switch used in the motor circuits is of the "Unit" type. The mechanical power for operating each switch is supplied by air under 80 lbs. pressure, while the admission of the air to the piston of each switch unit is controlled by an electromagnet which receives current from a 14-volt storage battery. There are, therefore, on the locomotive three electrically distinct systems of wiring; the 11,000-volt primary circuits to the step-down transformers; the lower-voltage motor circuits (corresponding to the secondary circuits from the transformers and the equivalent 600-volt, direct-current circuits) and the battery electromagnetic circuits.

The switches are similar to those used in direct-current work. They are arranged in groups for convenience, and the switches of each group have their magnetic blow-out coils placed mechanically in the same line so that they assist one another in producing the blow-out flux. Each blow-out coil consists of two complete turns built up of copper sheets insulated by Japan for the purpose of decreasing the losses from eddy currents. Precautions are taken also to minimize the eddy currents in the iron cores of the magnets; the pole faces are not laminated,

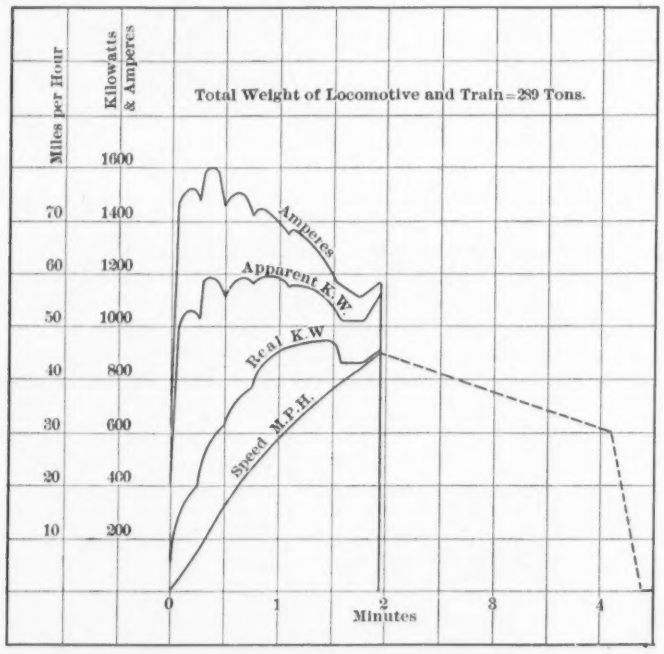


FIG. 7.—ACCELERATION TEST OF LOCOMOTIVE.

however, but slots are cut across them in such direction as to prevent the production of excessive eddy currents. It is worthy of note in this connection that if a current of a certain value is to produce a given flux, the reactance is less when a magnetic core is used than when air alone is depended upon to convey the flux. For a certain frequency, the reactance is proportional to the product of the flux and the turns, and the less the number of turns required for the production of a certain flux, the less will be the reactance. It will be seen, therefore, that the magnetic core which is more or less desirable for direct-current is practically essential for alternating current. As is the practice with the unit switches, a powerful spring serves to open the switch rapidly when the air is released from the cylinder, the piston of which holds the switch closed, and this same spring holds the switch in the inactive position when either the air supply or the current to the control magnet is interrupted.

The locomotive may be controlled from either end by means of a master controller to which only the 14-volt battery circuits are led. The master controller is of the usual drum type, but its handle is somewhat different from that of the ordinary street-car controller. The handle resembles somewhat the throttle lever of a steam locomotive; it is provided with a gear mechanism which allows the drum to be revolved through about twice the arc covered by the lever. The reverse lever is mounted immediately below the operating lever of the controller. The circuits which run to one master controller are directly in multiple with those to the other controller. A continuation of these circuits through flexible leads from one locomotive to another allows any number of locomotives to be operated simultaneously from one master controller.

There are two pantagraph bow trolleys for collecting the current from the 11,000-volt overhead conductor system. The upward pressure against the wire is supplied by springs in the base of the pantagraph equipment. Compressed air is admitted to a cylinder when it is desired to lower the collector. When the collector is in its lowest position, a catch engages the mechanism and holds it in place. The catch can be released by means of an electropneumatically operated lever when compressed air is on hand, or it can be released manually when desired. The framework of the pantagraph mechanism is built up of steel "bicycle" tubing; the collector bow is a broad strip of soft copper. It is intended to "zig-zag" the overhead wire so that the wear may be uniform over the bow. The trolley mechanism is mounted on massive porcelain insulators bolted to the roof of the locomotive.

For use over the New York Central portion of the route, there have been provided both an overhead direct-current pantagraph trolley and a system of third-rail contact shoes. The direct-current trolley is of the same general type as that used for the high-potential collectors, and it is mounted immediately over the center of the locomotive. There are two mechanically separate but electrically interconnected contact shoes on each side of each truck, so that there are a total of eight shoes per locomotive. These shoes are designed for use with either an over-running or an under-running rail, the mechanical pressure in each case being supplied by springs. On account of the fact that no third rail will be used over the high-potential portion of the route and the projecting shoes in their normal position would be liable to strike any small obstruction along the side paths, a device will be used for lifting the contact shoes out of the way when the locomotive is using alternating current. This device will be operated electropneumatically, and will be automatic so that when the alternating-current circuit is completed the shoes will be lifted from the rails.

All of the controlling mechanism of the locomotive is placed within the cab, no parts being carried below the floor except the electric cables and the air pipes. In addition to the various switch groups, and the two main transformers referred to above, the cab contains an air compressor driven by a compensated motor of the same general type as the main driving motors. The circuits to this motor are controlled automatically by the pressure of the air in the receiver, which is also placed within the cab. The four main traction motors, the high-potential transformers and the main circuit rheostats are cooled by air furnished at low pressure by means of a motor driven centrifugal blower, which obtains air from the inside of the cab itself. The low pressure air has two paths. One path passes first through the transformer then through the rheostats. The other path leads directly to the motors. It enters the armature near the shaft, passes around and between the armature laminations and flows outward through ventilating ducts in the field cores and reaches the outer air through perforated caps on the frame of the motor. Since a considerable volume of air is required for each motor, and it is undesirable to cause the air to assume a high velocity, it was necessary to provide a large flexible conduit between the air passages on the cab to those on the motors proper. The flexible conduit is made up of heavy canvas tubing, which is reinforced with wire and given an accordion plaiting. It is stated that by the use of the air blast the temperature of the motors under load has been so decreased that the continuous rating is almost equal to the one-hour rating. Tests which have been made on the first locomotive equipped show that it will, without difficulty, meet all the requirements for which it has been designed. Fig. 7 gives the observed acceleration curves for the locomotive with a train, the combined weight of which was 289 tons.

The Work of the Lewiston and Auburn Electric Light Company.

ONE of the most progressive central station organizations in the State of Maine is the Lewiston & Auburn Electric Light Company. The twin cities of Lewiston and Auburn are located one on each side of the Androscoggin River, about 40 miles from Portland, their sites being especially favorable to the utilization of one of the finest water powers in this country. In 1840 there were less than 2,000 people in Lewiston; then the era of manufacturing by machinery and the utilization of natural water powers began to develop on a large scale, so that to-day Lewiston is the second city of Maine in population, numbering about 28,000 people, while Auburn has a population of 14,000. Cheap power has been a marked factor in this increase of inhabitants and in the personal and real estate valuation, the latter having increased more than seven-fold in the six decades.

The Lewiston & Auburn Electric Light Company commenced operations in February, 1884. It was one of the pioneer electric light companies of Maine, and among the first in New England to introduce incandescent lighting. Four years later a competing company, the American Light & Power Company, was formed, and in October, 1901, the controlling interest in both properties was bought by Messrs. Libbey and Dingley, of Lewiston, and merged under the title of the older company. These gentlemen realized the future of electric power, and bought a water privilege at Deer Rips, on the Androscoggin River, about three miles from Lewiston, and in the spring of 1902 began development. A large power plant was built at this point, and at the present time every street car in Lewiston and Auburn, the local and interurban cars of the Lewiston, Brunswick & Bath Street Railway, the cars of the Auburn & Turner Railroad, every electric street lamp in Auburn, every commercial electric motor and every commercial or residence electric light in the two cities is operated from the main power house of the company at Deer Rapids. In all this territory, aggregating some 35 sq. miles and 42,000 people, there is not a single steam-driven isolated electric plant, and in but one or two instances have the mills upon the river bank equipped their turbine shafts with generators. The officers of the Lewiston & Auburn Electric Light Company are: President, H. M. Dingley; treasurer, H. S. Libbey, and superintendent, F. D. Gordon.

An interesting feature of the equipment is the entire absence of anything driven by steam. No reserve power is carried in the shape of boilers and engines, for the reason that the flow of the Androscoggin is never seriously diminished, even in times of great drought. The stability of the river is due to the famous Rangeley Lakes, which constitute its head waters. These lakes form enormous natural storage basins, so that there is very little chance of any falling off in the power supply farther down. The flow in the river averages 1,800 cu. ft. per second, and the head at the power house is about 29 ft. 6 in.

The main station at Deer Rips contains at present two 750-kw General Electric, three-phase, 11,000-volt, 60-cycle alternators, with a normal speed of 180 r.p.m., each direct-connected to a pair of horizontal 42-in. Stilwell-Bierce turbines equipped with draft tubes. The exciter plant consists of two 100-kw, 125-volt, General Electric direct-current generators, also direct-coupled to their respective water wheels. No transformers are installed between the generators and the line. The wheels are governed by the new governor of the Holyoke Machine Company, Worcester, Mass., and the resulting regulation comes close to 1.5 per cent with a combined railway and lighting load. A third 750-kw unit will soon be installed.

The company also has three auxiliary stations—one at he Lincoln Mills in Lewiston and the other two on the banks of the Little Androscoggin River in Auburn. The Lincoln Mills station is essentially a sub-station for distributing current to Lewiston. Power is transmitted to this station from Deer Rips over two three-phase aluminum circuits equivalent in cross-section to No. 1 copper. A lightning arrester outfit for the 10,000-volt line is installed in a separate brick building just outside the Lincoln Mills station, which occupies a portion of the basement of the factory of Messrs. Libbey and Dingley. At Lincoln Mills are four 500-kw General Electric air-cooled transformers and one extra 500-kw transformer, which is held in reserve as a spare unit. These reduce the line voltage to 2,200, two-phase, and at this potential current is supplied through Lewiston and Auburn. There are

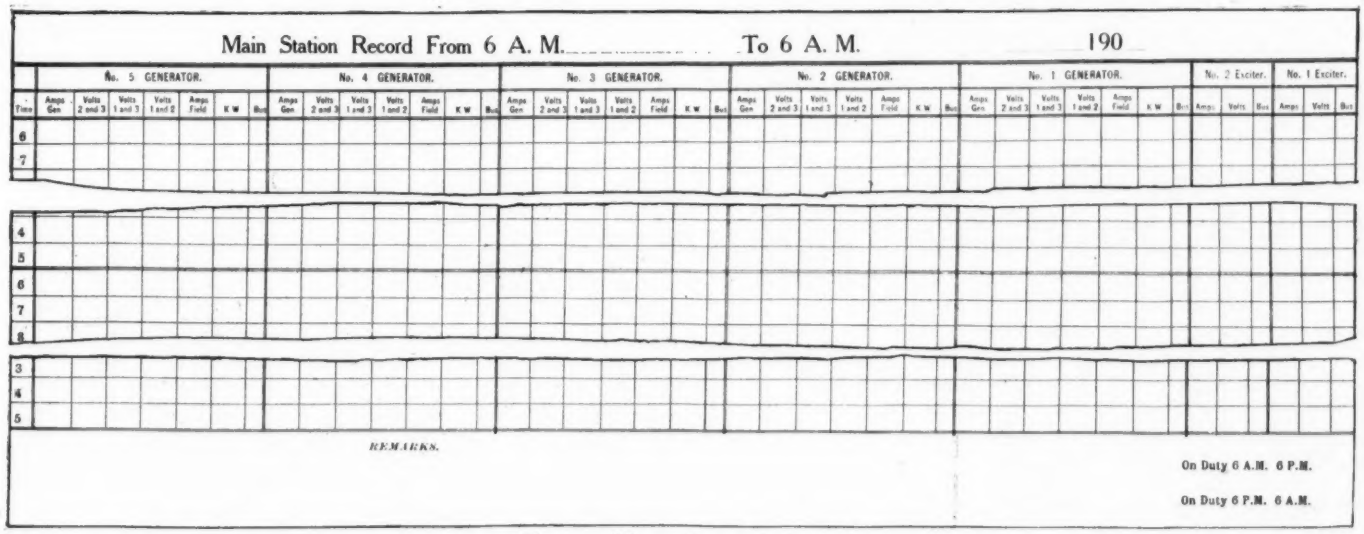


FIG. 1.—MAIN STATION RECORD.

also several old belted generators at the Lincoln Mills formerly operated by water wheels, which can be pressed into service in case of need. One of these, a 180-kw set, is frequently employed as an auxiliary to the Deer Rips plant. The two generating plants at Auburn each contain a 180-kw belt-driven alternator, but only one of these plants is ordinarily used, and that only during the hours of 4 to 6 p.m., when the evening peak load comes on. These stations are multiplied on the busses at Lincoln Mills, and railway and lighting service fall upon the same machines at the Deer Rips power house. Two other transmission lines are run from the Deer Rips station, one to the rotary converter sub-station of the Auburn-Turner Railroad Company at Turner, and the other to the sub-station of the Lewiston, Brunswick & Bath Street Railway at Lewiston. A 200-kw rotary and a Gould storage battery are in service at Turner, and a 500-kw rotary and a 320-amp.-hour accumulator battery at Lewiston. No exciter battery is in use at the Deer Rips power house. The transmission from Deer Rips to Turner is 65 miles long and from Deer Rips to the Lewiston street railway sub-station it is about 5 miles.

STATION RECORDS.

At Deer Rips recording wattmeters are used on the feeder panels, and hourly readings are taken of the current and voltage on generators and exciters, as shown in the accompanying chart entitled "Main Station Record" (Fig. 1). The shifts are 12 hours long. The chart is of interest chiefly on account of its

simplicity, the columns for voltage records between different phases being especially well arranged. Synchronizing is accomplished by lamps and the synchroscope. At Lincoln Mills frequently indicators of the horizontal edgewise type are in service, and the records are taken hourly as outlined on the accompanying "Sub-station Record" (Fig. 2). The frequency records are useful in discussing motor speeds with customers in case of complaint, aside from their direct indicating value and check upon the governor performance. Recording voltmeters are used in the railway battery sub-stations, and power factor indicators are also in service at these points. The power house at Deer Rips is served by a 25-ton hand crane. This plant began operation in November, 1904.

DISTRIBUTION.

There is no conduit construction in either city. The poles used are mostly chestnut, varying from 35 ft. to 50 ft. in length. Oil transformers have almost entirely superseded air-cooled types on the distribution system, and small, scatered units are being replaced in groups by larger transformers. At present the largest outside transformers are of 50-kw rating. Seven of these are now in service, all being attached to poles.

The entire distribution system is on an alternating-current basis in each city. There are two street lighting circuits for Auburn, carrying 126 enclosed arc lamps, 6.6 amp., and four 25-

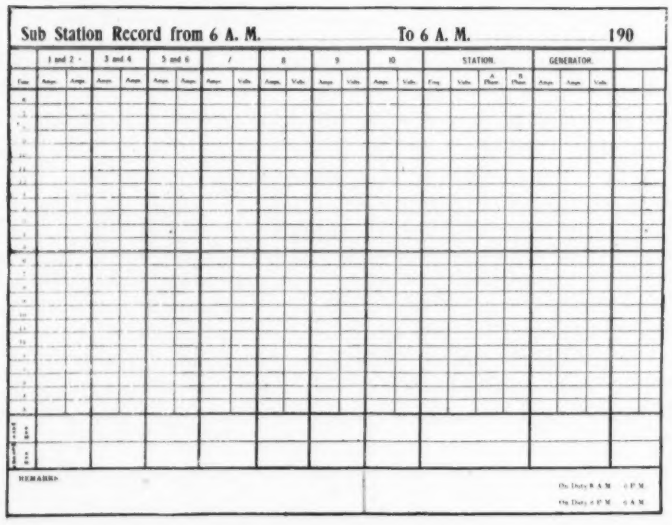


FIG. 2.—SUB-STATION RECORD.

cp series incandescents. There are two two-phase, 2,200-volt power circuits, one each for Lewiston and Auburn, and four single-phase, 2,200-volt lighting circuits, two going through each city. The transmission lines are not patrolled at night. In the two cities are 1,248 connected hp in induction motors, 116 in all, the largest being 75 hp; 32,000-cp incandescent lamps, 476 commercial arc lamps, small signs and electric flatirons. Small single-phase motors are being pushed rapidly into service; practically every grocery of note is equipped with a small motor for coffee grinding; every machine shop in the two cities is driven by induction motors and every printing press. Speed regulation when necessary is by cone pulleys. Sewing machine motors are also exploited by the company. The largest motor allowed on lighting circuits is 5 hp.

In regard to connecting up remote customers, the company will construct its necessary line if assured of adequate financial return, but otherwise extensions are made slowly. Ordinarily the company does not like to install more than four poles and the necessary wire in order to bring a single consumer into its system. There are no farm customers on the system. The company has not had very much success in the use of creosoted poles.

RATES.

The rates for incandescent lamps are 9 cents per kw-hour by meter, with $1 per month minimum charge. Consumers using over $100 worth of current per month are given an 8-cent rate. Signs are operated at incandescent rates. The power rate is 7 cents per kw-hour as a basis and a sliding scale of discounts, with a minimum charge of $10 per hp per year. The following data are extracted from the power rate tariff sheet:

Power Rate.

List price, 7c. per kw-hour or 5.22c. per hp-hour.

Meter reading, kw-hours per month.	Equivalent to to steady hp.	Discount, per cent.	Cents per kw-hour.	Cents per hp-hour.
100— 175	.53	10	6.3	4.71
475— 650	2.53	30	4.9	3.67
1050— 1200	5.58	44	3.92	2.94
1600— 1800	8.48	53	3.29	2.46
2000— 2400	11.66	60	2.80	2.1
3200— 3500	16.96	66	2.38	1.78
5000— 6500	26.25	69	2.17	1.62
10000—12000	53.00	72	1.96	1.47
16000—18000	84.80	75	1.75	1.31
20000 and above	106.00	77	1.61	1.2

Interior arc lighting is charged on the incandescent basis of meter records. The charge for the arcs for street service in Auburn is $55 per lamp per year, and incandescents of 25 cp cost $12 per year. Four commercial laundries use large electric flatirons at a rate of 4 cents per kw-hour.

The municipal plant in Lewiston supplies arc lamps only for street service. These are of the old open-arc direct-current style and are operated by several generators of ten or fifteen years ago located in the Lewiston Pumping Station, and driven by water wheels. There are estimates to the effect that the cost to the city is $35 per lamp per year, but as no report of this work is printed or prepared, the money being simply appropriated in a lump sum, it is pretty hard to say just what the actual cost is, including depreciation and lost taxes. The quality of light is certainly much inferior to that given by the modern enclosed arcs at Auburn.

BUSINESS GETTING.

Every employe of the Lewiston & Auburn Company is an active solicitor of new business whenever an opportunity is seen, although no regular organized force devotes its attention to such problems. The company does inside wiring for its consumers and by so doing feels that it can give a better service than if the customer supplied the installation. This work is done practically at cost, and it insures the consumer an adequate installation for the load proposed, makes certain reliable work and thus protects the company. In the prosecution of this work it is often the case that sound advice can be given to the consumers about their installations, and general satisfaction assured. Printed matter from the manufacturers is widely circulated, generally when the bills are presented, and the company maintains an exhibit of lighting and heating appliances at its offices. In the spring house-cleaning season the point is often made that then is a specially favorable time to have a house wired for electric lights.

The heating exhibit comprises a considerable variety of flatirons, ovens, broilers and chafing dishes, all wired for demonstration on the spot and connected to a recording wattmeter so that the prospective customer can see for himself just what the power consumption is going to be. In the superintendent's office is an especially fine display of lamps, shades and fixtures in different styles and colors. Some of these are installed in a glass cabinet and the illumination is very attractive. The offices are heated by electric radiators; electric cigar lighting equipment is in demonstrative service, and Meridian and high-efficiency lamps are displayed freely.

The company in the last two years has reduced the lighting rate from 15 cents to 9 cents—a reduction of 60 per cent. It does not renew lamps free on meter rates, but sells them to its customers at 15 cents each, net. A few customers are still on flat rates, and under these conditions three lamp renewals are made without charge. Blotters are often sent to customers with appropriate advertisements thereon. The newspapers are used somewhat, but not to any great degree. At a recent state fair held in Lewiston the company had a large exhibit of electrical apparatus which attracted a great deal of attention from the public. Electric flatirons are supplied free on 30-days' trial, and last year, out of 50 irons installed, only three came back. A fair average of the cost of operating an electric flatiron in these cities is 75 cents per month. The electric sign business has not

been developed as yet to any great extent, but matters are moving in the right direction. The company has a small sign at its office in Auburn, but thus far has not employed one in Lewiston. Customers are encouraged to read their meters and are taught how to do it when an installation is made. The price of coal in Lewiston is about $5 per ton and the cost of gas $1.35 per thousand feet. Gas competition is met by alternating-current enclosed arc lamps, Meridian and graphitized carbon General Electric incandescents.

The results which have been attained have been largely due to the personal and aggressive work of the employes of the company, rather than to any highly systematized advertising scheme. Such a course has worked out well, but in a larger city routine methods of getting new business would probably have to be more extensively followed. At Lewiston and Auburn the personal touch has been the key to the situation, rather than elaborate canvassing and "follow-up" letters. On the physical side water power is the foundation of the prosperity of the community, and it is little short of remarkable that in a city the size of Lewiston a central station should be able to hold down the competition of isolated plants so well. The rates for power and light are naturally reasonable by virtue of the low cost of generation, but only effective work could have educated the community to such an extensive use of electricity on the central station plan. With the facilities for additional power which the river affords, there is little question that the commercial growth of Lewiston and Auburn will be continuous and gratifying, and electricity will doubtless be the principal means of bringing the community's chief material asset home to the average citizen's personal profit and advantage.

Recent Electrochemical Developments.

LEAD REDUCTION.

In the Salom process for electrolytic lead reduction, which has been worked on a large experimental scale at Niagara Falls, though it has not yet been reduced to commercial practice, finely ground galena is used as cathode with a sulphuric acid electrolyte. The cathodic reaction is the reduction of metallic lead with evolution of hydrogen sulphide.

A process recently patented by Mr. C. P. Townsend may be briefly characterized as a Salom process with fused electrolyte, since Townsend, like Salom, obtains the lead by cathodic reduction. In other respects there are, however, distinct differences. The fused bath of Townsend consists of a haloid salt of an alkali or alkaline-earth metal. The sodium liberated from the molten bath combines with the sulphur of the ore and sodium sulphide accumulates in the bath until it is sufficient in quantity to carry the current. By reason of the great difference in specific gravities the ore floats upon the surface of the lead beneath the electrolyte and remains therefore in the field of most active reduction until it is itself reduced. A high current density may be used and the reduction proceeds therefore with great rapidity. The process has undoubtedly distinct practical advantages.

BATTERY INVENTION.

E. L. Opperman claims that an exceedingly porous, and at the same time, hard and tenacious active material for storage battery plates may be obtained by making a mixture of the usual active oxide with ground or powdered animal hair or wool. The best results are obtained with a proportion of one-half to one and one-half per cent of hair in the mixture.

Two patents granted to F. Mouterde and to H. B. Hallock respectively refer to mechanical details of construction of storage batteries. The peculiarity of the latter patent is that only two plates are used, one above the other in horizontal positions.

A recent patent of H. J. Brewer refers to mechanical details of construction of a zinc electrode for primary batteries. E. W. Schneider proposes to arrange a battery of several dry cells in such a way that one of the same is kept separate from the others and is called upon to furnish current only to boost the voltage when the other cells have become somewhat exhausted. For this purpose he provides an end-to-end reversal by which the cell may be thrown into the generating circuit.

Letter to the Editors.

Recharging Automobiles.

To the Editors of Electrical World:

Sirs:—In your issue of March 31, there appears in the Patent Record a brief allusion to a device, which it is stated, was patented by me. Allow me to quote:

"815,360. Device for Recharging Automobiles. A special type of induction motor having two commutators, is employed upon a vehicle and when the batteries are charged from an alternating-current circuit, the motor is arranged to be operated as a rotary transformer so that the batteries may be properly charged."

Induction motors with commutators are rare birds, and those having *two* commutators would be masterpieces of electrodynamic design; but when it is considered that this induction motor, in addition to these unusual features, may be run from a storage battery as the source of supply, and may also act as a rotary converter, it seems to me the most marvelous contraption in the whole range of the electrical art.

As a matter of fact, my invention consists simply in putting slip rings on the ordinary automobile motor, connecting them with the armature winding, and so arranging the field windings that the machine may be run in the usual fashion as a series motor, to propel the vehicle; or by mechanically disconnecting from the driving wheels, it may operate as a rotary converter to charge the batteries from alternating current, if this be the only available source of supply. It adds nothing to the weight of the vehicle, and the additional cost, as compared with the ordinary motor, is insignificant. It is always there when needed and ready for use, and therefore greatly increases the range of action and usefulness of the electric automobile. It has not, however, the extraordinary features recited in the notice quoted, and I must admit, reluctantly, that it bears no marks of genius, but is only a commercial machine for the purpose as stated above, and I trust of some future importance in the electric automobile field.

New York. Lamar Lyndon.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Single-Phase Unipolar Dynamo.—Huppert.—The author suggests the use of the unipolar machine for single-phase current. He first discusses the reaction of the rotor currents on the stator. The unipolar motor may be built either with direct supply of electric power into the rotor performing mechanical work or by inductive transmission of the power from the stator to the rotor. The unipolar series motor has properties similar to that of the bipolar series motor. The characteristic features of the repulsion motor may also be transferred to a unipolar machine.—*Elek. und Masch.*, March 4.

Design of Transformers.—Korndoerfer.—A paper on the best way of proceeding in the design of transformers. The proper choice of the maximum flux per square cm. of iron and of the maximum current density in the copper are of fundamental importance since these quantities determine efficiency and price. It is difficult to give exact rules concerning this choice since these quantities depend on the type of the design, the method of

cooling and the quality of the iron. When these values have been selected, the author shows how to find by simple calculation the diameter of the core from which all further dimensions may be easily determined. Some numerical examples are given.—*Elek. Zeit.*, March 22.

Direct-Current Dynamo Design.—Breslauer.—The conclusion of his article. In the first part the author had given some details of a direct-current machine which, in spite of an unusually high reactance voltage and large armature reaction, was perfect with respect to commutation. This satisfactory behavior is primarily due to the shape of the pole horns which are shown in Fig. 1. It will be seen that the air gap varies between 4 mm.

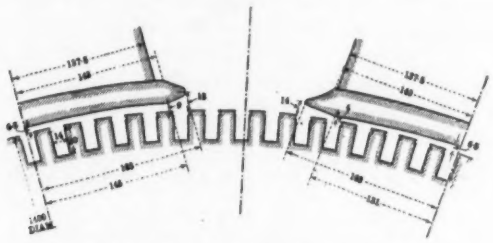


FIG. 1.—SHAPE OF POLE FACES.

and 9 mm. and thus a strong commutating field is created just at the point where the short-circuit has to take place. The effect of this device is to prevent field distortion by creating an artificial distortion in the opposite direction at no load which will be partly or completely balanced at full or overload as may be desired. If, for instance, as in this case, the distorting ampere-turns of the armature are approximately equal to the ampere-turns for air, teeth and core, one would have to make the gap on the leading horn of the pole half as great as on the trailing horn. This has the same effect as if on the leading horn the field ampere-turns were doubled at no load. When the load comes on, half of these ampere-turns will be balanced, and the resultant field will be normal and just the same as if the air-gap had been equal all along the periphery of the pole face. In order to make proper use of this commutating field, a considerable lead of the brushes in the direction of rotation is required. This, on the other hand, would cause sparking at no load if the induced e.m.f. due to the commutating field were too strong. Given the reactance voltage, however, the counter e.m.f. is also fixed, and is bound to be about twice as great at no load as at full load owing to the inequality of the air-gap. Hence an additional well-known artificial device was employed to keep down the current produced at no load by the outer commutating e.m.f. This consisted of resistances fixed in the commutator lugs in the form of manganin strips. The author discusses the losses and efficiency of this machine, and its mechanical construction, and gives some figures for the active material used in the construction.—Lond. *Elec.*, March 23.

Direct-Current Dynamos.—Gennimatas.—A highly mathematical paper on the mean voltage between two adjoining commutator segments.—*Elek. und Masch.*, March 25.

Direct-Current Dynamo.—An illustrated description of a Vickers 1,400-kw, shunt-wound, direct-current generator. It is designed for 460 volts at a speed of 100 revolutions per minute.—Lond. *Eng'ing*, March 9.

Commutation Poles.—Arnold.—A paper illustrated by diagrams discussing the path which the magnetic flux takes in a direct-current machine with special commutation poles (interpoles).—*Elek. Zeit.*, March 15.

Lamps and Lighting.

Combined Nernst and Welsbach Lamp.—Herz.—A Welsbach mantle of metallic oxides is a non-conductor at ordinary temperatures, but becomes a good conductor when heated. In order to increase the temperature of the Welsbach mantle and therefore its efficiency, the author proposes to heat the mantle by the gas flame as usual and to supply it also with an electric current. Nothing is stated concerning the methods of doing this.—*Zeit. f. Beleucht.*, March 10.

Power.

Induction Generators for Power Transmission.—A canal has been built in the upper valley of the Rhine (Switzerland) for conducting the waters, which sometimes accumulate here with surprising rapidity, in a safe and quick manner to the Lake of Constance. On its way to the lake, the canal drops in three steps of about 10 ft. each, and it was decided to utilize these falls for the generation of electric power. Accordingly, three generating staions were built, and they have been in regular service since the beginning of this year. The main station, which is situated at Montlingen, is equipped with 3 three-phase 250-hp alternators of the rotating-field type, while the two other stations, which are at Blatten (about 2½ miles from Montlingen) and at Lienz (about 3.1 miles from Montlingen) have each been provided with two 250-hp asynchronous generators. These are simply induction motors with short-circuited rotors driven above synchronous speed. They supply electric power to the network in much the same manner as a railway motor of the induction type returns power to the line when the train runs at an increased speed down hill. Such asynchronous generators, as is well-known, do not require a voltage regulation and they do not need to be synchronized. These stations generate at 10,000 volts between the phases, and supply power into a distribution network having a total length of about 35 miles. The voltage and frequency of the network is determined by the synchronous generators at the main station, and the power delivered by each of the asynchronous generators depends simply on the power of the turbine by which it is driven. If the power taken from the network decreases, the alternators at the Montlingen station show a tendency to race, and the normal state of affairs is reestablished by simply cutting out one or more of the asynchronous generators or by shutting down their turbines. In each of the two stations with the asynchronous generators there is only one man in attendance and the switchboard contains only ammeters and switches.—Lond. *Elec.*, March 23.

Danger from Electricity in Mines.—Beyling.—An abstract of a paper on the possible ignition of mine gases from the sparking of motors and other electrical machinery. Exhaustive experimental investigations have been made in Germany and the results of these experiments show that electrical machinery to be used in coal mines, in which the presence of explosive gases is possible, should be constructed with the greatest care, to reduce sparking to a minimum, and that such machines should then be enclosed in casings of sufficient strength to prevent the possibility of any bursting by the explosion of their contents, the castings being provided with openings of sufficient size to permit the escape of the products of explosion, and yet not large enough to allow the escape of flame. Further experience with the behavior of explosive gases will enable definite data for the design of motors and other appliances for coal mines to be determined.—*Eng'ing Mag.*, April.

Control of Electric Motors.—Scott.—A long illustrated paper on speed characteristics and the control of electric motors. In the present installment the author discusses direct-current motors, and deals first with speed control by field strength variation in the case of shunt, compound and series motors. He then discusses speed control by armature voltage variation, either by connecting a resistance in series with the armature, or by using a special generator giving variable voltage or by connecting the motor with several wires between which different voltages are available. The author points out that there are several points in favor of control by variation of the strength of the field when it is desired to obtain adjustable speeds which shall be constant and independent of load variations. The motor and control devices are simple. The supply circuit is of the simplest kind without special generators or additional wires. The current is always a minimum as no low voltages are used which would require a greater current for a given power. The author then discusses the limitations of the different methods of speed variation. The two elements which limit the range of field adjustment of a given motor are the saturation of its magnetic circuit and the heating of its field coils. In the method using the variation of the e.m.f. applied to the armature one

cannot raise the voltage above a certain maximum limit which depends upon the winding and the commutator design. The armature current and consequently the motor output (under given conditions of field strength and armature voltage) has its limitations in sparking at the commutator and heating of the conductors. There is also a mechanical limit to the armature speed above which there is liability to accident.—*Eng'ing Mag.*, April.

Traction.

Single-Phase Railway Motors.—SCHOEPF.—A paper read before the Manchester Section of the (Brit.) Institution Elec. Eng., on single-phase railway motors and methods of controlling them. The author gave characteristic curves of various single-phase series motors of the Westinghouse Company. He remarked that the ideal method of voltage variation in the supply of power to single-phase motor is by means of an induction regulator which provides a uniformly increasing voltage without interruption of the supply. He finally referred to multiple-unit control. In the discussion the question of the repulsion motor versus the series motor was brought up. Cramp said that it is in commutation that the series motor scored, as salient poles could be used while a small air-gap and a resultant practically rotating field are essential for the repulsion motor. Lastly for different frequencies the repulsion motor is far better, since for anything like reasonable efficiency at full load the series motor must run well above synchronism, while the repulsion motor runs at about three-quarters synchronous speed. Thus repulsion motors can be built for frequencies of 40 periods per second, in which case series motors are almost out of the question. This is of special importance in England where they might wish to use alternating-current commutator motors in connection with ordinary lighting circuits. Almost any system of control suitable for one type of motor is suitable for the other, but with repulsion motors one has a choice of systems that does not exist with series machines, since the control may be effected by rotor resistance as is done in the Schueler motor and the ordinary induction motor. This enables putting a high voltage on the stator and getting rid of the bulky transformer. Schoepf said that the straight series motor is good at starting, but the repulsion motor is better while running.—Lond. *Elec.*, March 23.

Single-Phase Locomotive.—SOLIER.—An illustrated description of the new single-phase locomotive of the Oerlikon Company for use on the road from Seebach to Wettingen, which has already been noticed in the Digest.—*L'Eclairage Elec.*, February 17.

Double-Gauge Electric Locomotive.—A German machine factory is connected to the adjacent railway station by a system of tracks whose gauge is partly 1,435 mm. and partly 700 mm. Altogether, the connecting lines between the station and the works are about one mile in length. These lines are now to be electrified, and the same locomotive is to travel over both the standard-gauge and the narrow-gauge portions of the system. To this end the locomotive is equipped with four axles, of which the two outer ones correspond to the standard-gauge and the inner ones to the narrow-gauge. There are eight wheels, each of which is 650 mm. (25⅝ in.) in diameter, and the "standard-gauge" wheels are outside the locomotive frame, while the "narrow-gauge" wheels are inside the frame. Either pair of axles can be raised or lowered by the motorman in the cabin by a simple screw mechanism. The arrangement is as follows: Each of the outer axles is connected to the neighboring inner axle by two substantial levers, and these levers are pivoted at their centers to the frame, and extended beyond the inner axles towards the center of the locomotive, where they engage with a strong screw operated manually by the motorman. The two 6-hp continuous-current motors are bolted to the locomotive frame and drive the wheels by means of double-reduction gearing having the ratio of 11.5 to 1. The teeth are always in mesh, and either the one or the other pair of axles is running idle.—Lond. *Elec.*, March 23.

Energy Consumption of Electric Carriages.—In order to test the energy consumption of electric carriages under favorable conditions, a 100-km. (62-mile) test run was recently organized in Paris over dirty and slippery roads, fog prevailing at the time. A number of carriages carrying four passengers, and weighing complete over 2 tons, covered the entire distance at an average speed of nearly 15 miles an hour, and consumed less than 160 watt-hours per ton-mile. The first prize was gained by a carriage entered by Vedrine, which required 155 watt-hours per ton-mile. The energy consumption of this vehicle in ordinary conditions is from 110 to 120 watt-hours per ton-mile.—Lond. *Elec.*, March 23.

Car Wheel Acceleration.—An article giving formulas for calculating the energy expended on car wheels during acceleration, with figures from actual practice.—Lond. *Eng'ing*, March 9.

Installations, Systems and Appliances.

Regulating the Voltage in Alternating-Current Distributing Networks.—BUECHI.—A description of an apparatus which consists essentially of a high voltage switch with an inductance in combination with an autotransformer. The autotransformer produces the additional adjustable voltage and may be used to advantage since the additional voltges required will probably never be more than 10 or 20 per cent of the whole tension. According to the position of the switch, more or less windings of the transformer are in series with the line. By the use of the autotransformer it is possible to transform only a small part of the total power in the line to another voltage. Fig. 2 shows the application of the system to a single-phase current network for four different regulation voltages. The bus-bars of the power house are connected to the line, *aa*, at which there exists a constant voltage. *T* is the autotransformer, the exciting windings of which are connected between the two conductors, *aa*, while the regulating windings are in series with one of the two conductors. The high-voltage switch is indicated by 1, 2, 3, 4 and is connected with the line, *bb* (the voltage of which is to be regulated), through two auxiliary bus-bars which may be short-circuited by means of 5. If 1 alone is closed, all regulating windings of the transformer, *T*, are in series with *aa* and the voltage is raised in *bb* to its maximum possible point. In order to decrease the voltage in *bb* it is necessary to close 2 instead of 1. If the auxiliary bus-bars, *c*, were not provided and if 1, 2, 3, 4 were connected to *b* by means of a single connection, it would not be possible to make the change from 1 to 2 directly, since in this case either a part of the regulating windings would be short-circuited or it would be necessary to interrupt the line. In order to prevent the necessity of interrupting the line or the short-circuiting of the windings, the auxiliary bus-bars, *cc*, are provided in combination with 5 and the inductance, *JW*. Before 1 is disconnected, 2 is connected to *cc*, since there is no longer any short-circuit between 1 and 2 as an inductance is provided which is of such a size that only the regular low current can flow through the closed regulating windings. 1 is then opened without interrupting the current, and 5 is closed in order to disconnect *JW* from the circuit. Assume that 3 is closed and that it is necessary to raise the voltage, then 2 is first closed, 3 is disconnected and short-circuited with 5. If 2 is closed and the voltage is to be raised still higher, 5 is first disconnected, 1 is closed and 2 is finally disconnected. Diagrams are given showing how modifications of this apparatus may be applied on two-phase and three-phase lines.—*Elek. Zeit.*, March 15.

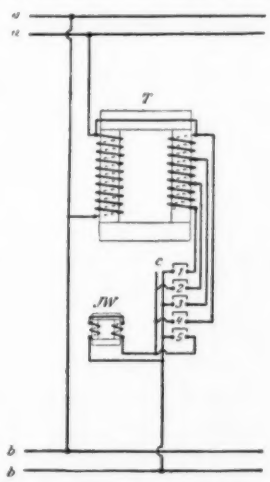


FIG. 2.—DIAGRAM OF VOLTAGE REGULATOR.

Electric Auxiliaries.—MANN.—An article on the betterment of power station economy by electric auxiliaries. The exhaust steam coming from steam driven auxiliaries is so valuable for heating feed water than the facts that such apparatus is rather inconvenient and uses rather more steam than it ought

to do, are often condoned. As an alternative to this system there is the possibility of using electric auxiliaries. In order to heat the feed water in this case the author makes the following suggestion for steam turbine stations. The steam at about atmospheric pressure, either a little above or a little below, within a steam-turbine casing, is admirably suited for this feed-water heating. It has performed its mechanical work, and withdrawing it does not disarrange the performance of the turbine itself except in so far as a certain amount of steam does not pass through all the wheels. The use of electric auxiliaries has the great advantage of convenience and ease of operation, resulting in an appreciable saving in wages for attendance.—*Eng'ing Mag.*, April.

Central Station Advertising.—Chapin.—An article giving hints on methods for getting new business for central stations by bringing before the people the possibilities of electricity.—*Cassier's Mag.*, April.

Electrophysics and Magnetism.

Internal Energy of Elements.—Soddy.—A discussion of the possibilities of making available the unknown storage of energy contained in chemical elements. This energy gets free when the atom breaks up as in the case of a radium atom when being radioactive. It is probable that the elements as a class all possess great internal energy, and that their characteristics of stability and permanence, and the failure of all attempts to change them by artificial means, are due to the existence of this internal energy. The forces at our disposal compared to those which are exhibited when an atom suffers change, are of a different and lower order of magnitude, and it is not to be expected, therefore, that the transmutation will become possible until we can control more powerful agencies than are at present available. Suppose that a way were known in which the element uranium, for example, which disintegrates to the extent of a thousand-millionth part annually, could be made completely to disintegrate in the course of a year. From 1 gramme of the element more than a thousand million calories could be evolved, would be equivalent to more than 1,000 kw-hours, and would suffice to keep a 32-cp lamp burning continuously throughout the year. By the expenditure of about 1 ton yearly of uranium, costing less than $5,000 more energy would be derived than is supplied by all the electric supply stations of London put together.—Paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng.; abstracted in Lond. *Elec.*, March 23.

Electrons.—Holzmuller.—A résumé of the foundations on which the modern theories of electrons are based.—*L'Eclairage Elec.*, February 17, 24.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Reyval.—Some notes on the successful application of the Birkeland-Eyde process in Norway. The fundamental idea is to move the air through an arc discharge which is magnetically deviated so as to form a flaming disc.—*L'Eclairage Elec.*, February 24.

Units, Measurements and Instruments.

Damping Device for Electromagnetic Instruments.—Dessauer.—An illustrated description of a new damping device specially suitable for electromagnetic alternating-current switchboard instruments. The construction is shown in Fig. 3. A liquid used for damping is contained in a hermetically closed vessel so that any change of the damping liquid, due to evaporation, etc., is made impossible. The vessel is of cylindrical form and closed on all sides, and is filled about one-half with liquid. The cylinder can revolve around its axle as is shown in the illustration, and the needle is firmly connected with the cylinder in such a way that the center of the side forms the starting point of the needle. If the needle is deviated, the cylinder revolves with it and the liquid in it must assume a new position of equilibrium. This gives a damping effect which may be adjusted by using more or less liquid and by using liquids of different specific gravities.—*Elek. Anz.*, March 1.

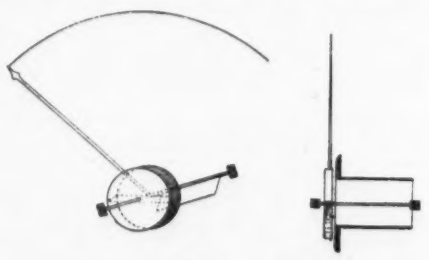


FIG. 3.—DAMPING DEVICE.

Connections of Three-Phase Meters.—Niethammer.—For measuring the power of a three-phase system double meters are now much used with the connections, as indicated in Fig. 4. In using such double meters in practice it is very important to take care that the connections of the voltage coils are made exactly as shown in Fig. 4, since otherwise the double meter does not properly measure the power consumed, but shows quite appreciable errors. Two wrong connections which the author has found in practice are shown in Fig. 5. It is very easy to find out whether the connections are right, at least if the power factor of the system is different from unity, which is always the case if induction motors are used. In this case the two meters must give essentially different readings. If they give the same readings there must be an error in the connections. Only when the power factor is unity do both meters (if properly connected) read alike. With a power factor of 0.87 the reading of the right-hand meter of Fig. 4 is only one-half of that of the left-hand meter. At a power factor of 0.5 the right-hand meter is at rest, and at a still lower power factor it reads backwards.—*Elek. und Masch.*, March 18.

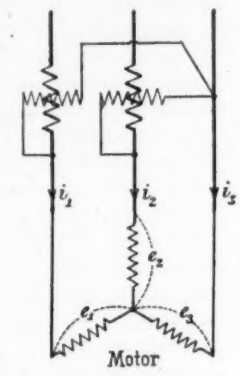


FIG. 4.—CONNECTIONS OF THREE-PHASE METERS.

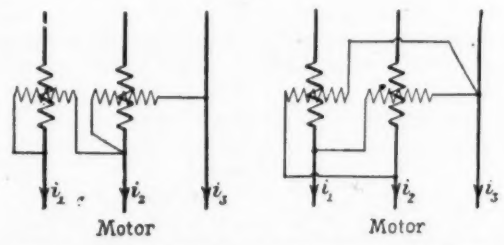


FIG. 5.—CONNECTIONS OF THREE-PHASE METERS.

Accelerometers.—Trotter.—A paper with illustrations on acceleration and accelerometers.—Lond. *Eng'ing*, March 9.

Electrochemical Equivalent of Silver.—Van Dijk.—A very full paper reviewing the results of previous investigators and giving his own work. The following table gives the values (corrected) obtained by various physicists:

Mascart	0.011155	Kakle	0.011181
F. and W. Kohlrausch	0.011182	Patterson and Guthe	0.01118
Rayleigh and Sidgwick	0.011176	Pellat and Leduc	0.011189
Pellat and Potier	0.011191	Van Dijk and Kunst	0.011180

Van Dijk devotes considerable space to a discussion of the corrections employed by Richards which led the latter to adopt the value 0.011175, and believes that his own result, $a = 0.011180$ is the true electrochemical equivalent of silver.—*Am. Jour. of Science*, April; from *Ann. d. Phys.*, No. 2, 1906.

System of Units.—Juppont.—An article suggesting a new system of units or rather a new system for determining the dimensions of physical quantities.—*L'Eclairage Elec.*, January 13.—Some criticisms of this article by Brylinski with replies by Juppont in *L'Eclairage Elec.*, February 17, 24, March 3.

Telegraphy, Telephony and Signals.

Measurement of Telephonic Currents.—Duddell.—A note on a lecture before the Royal Institution. The speaker emphasized the necessity for measurements in telephonic research, and described various apparatus, such as the delicate micrometer of Shaw for measuring the amplitude of the motion of a telephonic diaphragm, the thermogalvanometer and the oscillograph.

For producing a pure sound he uses either Campbell's vibrating bar or his own toothed-wheel inductor alternator. The chief experiment of the lecture consisted in showing simultaneously on a screen four series of waves indicating respectively the motion of the transmitter diaphragm, the wave-form of the current entering the line, the wave-form of the current at the receiving end of the line and the motion of the received diaphragm. Various vowel sounds were spoken into a speaking tube connected to the transmitter, and the effect of adding inductance and capacity in the artificial line was demonstrated by the shape of the curves. A thread was fixed to the diaphragm in each case and transmitted the motion to a light mirror fastened to a wire round which the thread was wound once, and the time element was given by a moving mirror driven at a uniform speed by an electric motor.—Lond. *Elec.*, March 23.

Miscellaneous.

Electric Needle.—Owen.—Experiments on fields of force due to electric charges suffer as compared with the corresponding measurements in magnetic fields by reason of the impracticability of obtaining an "electric needle" corresponding to the oscillating magnetic needle. But while it is true that a permanently electrified needle cannot be obtained, it is possible to have one that has equal charges of opposite sign induced by the field. The present paper contains an account of experiments on the use of such a needle for the measurement of electric fields, steady or alternating, and for the experimental illustration of some of the laws of electrostatics. After a presentation of the theory the author discusses the disturbances of the field due to the presence of the needle, and deals with the choice of the needle and with various applications, for instance, for measuring high voltages.—*Phil. Mag.*, March.

BOOK REVIEW.

Die Abstimmung Funkentelgraphischer Sender. I. Hälfte. By A. Slaby. Berlin: Julius Springer. 47 pages, 81 ill.

This pamphlet of 47 pages is a reprint of a series of articles upon the "Tuning of Wireless Telegraph Transmitters," published by Professor Slaby in the *Elektrotechnische Zeitschrift* during the year 1904. The series was continued during 1905, but the 1905 articles are not included in this pamphlet.

Professor Slaby is a professor in the Technical High School in Berlin, a personal friend of the German Emperor, and, after Mr. Marconi, has probably done more than any other man to bring wireless telegraphy to its present state of perfection. For several years past Professor Slaby has given a course in wireless telegraphy in the Technischen Hochschule in Charlottenburg.

In the present pamphlet the mathematical theory of different types of transmitter is worked out. He considers: (1) Transmitters with direct or ohmic linking of the oscillating circuit to the antenna, i. e., the oscillating circuit connected directly to the antenna. (2) Transmitters with inductive linking of the oscillating circuit to the antenna either through a condenser, or through a small electromagnetic transformer. (3) Transmitters in which the damping is made a minimum. No startling results are announced, the principles developed being those actually applied in the various commercial systems now in existence such as the Marconi, the Telefunken, the De Forest, etc.

BOOK RECEIVED.

Corso di Elettrotechnica. Volume II. Motori, Convertitori, Accumulatori, Sistemi e Impianti di Distribuzione, Lampade Elettriche, Trazione. By Guido Grassi. Rome: Casa Editrice Nazionale. 547 pages, 319 illustrations. Price, 16 lire.

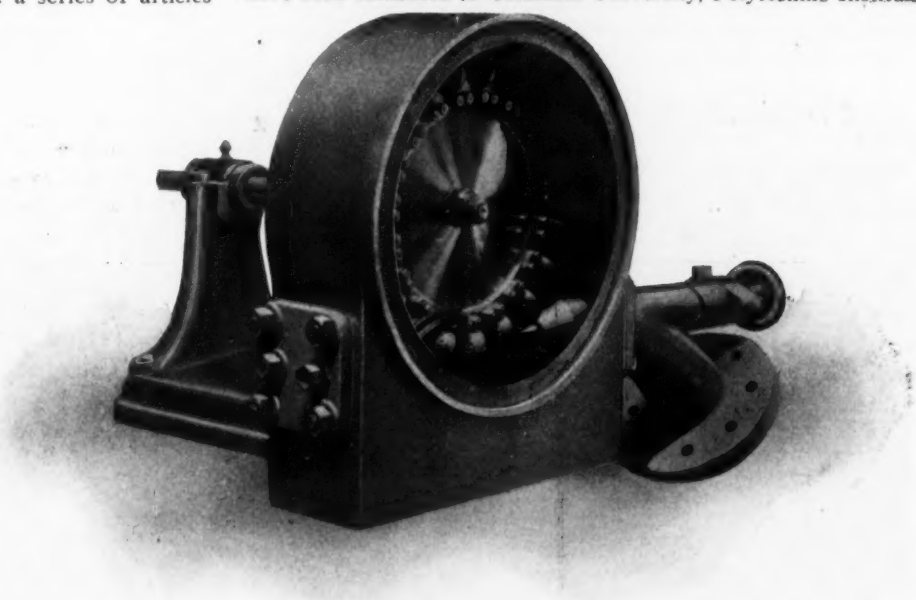
Doble Laboratory Water Motor.

The notable work that is being done in this country, especially in the Western States, in hydro-electric power development, is reflected in the increasing interest that is being taken by the engineering schools and technical colleges in electrical and hydraulic questions. Apparatus of the most improved types is being secured for the engineering laboratories for experimental and research work, as the faculties realize the necessity of having modern machinery for instruction purposes. In order to afford students means for studying the development of water power under high heads, the Abner Doble Company, of San Francisco, has designed a 12-in. water motor of the tangential type especially for laboratory use.

This small machine, which is illustrated herewith, is self-contained, and has the shaft extended far enough to carry a pulley or prony brake. The buckets are of the well-known Doble ellipsoidal type, of the same design as have been used so successfully on tangential water wheels up to 9,000 hp capacity. The water motor is provided with a Doble needle regulating nozzle for hand control, so that the jet may be varied to give the desired regulation in speed. The housing has plate glass sides in order that the students may easily observe the water acting on, and discharging from, the buckets.

These little Doble water motors embody the best workmanship that can be turned out, and are designed and finished exactly upon the same lines as the largest Doble wheels, the buckets being formed of independent gun metal castings, ground and polished on the hydraulic surfaces, and bolted to the wheel disc, each by two body-bound bolts fitted into reamed holes.

The motors are designed and constructed so as to operate under heads up to 1,000 ft., and are, therefore, admirably suited for experimental use in a hydraulic laboratory under all pressures that are commonly available. Laboratory wheels of this type have been furnished to Columbia University, Polytechnic Institute



LABORATORY WATER MOTOR.

of Brooklyn, University of Iowa, University of Missouri, University of Illinois, University of Texas, Michigan School of Mines, University of Wisconsin, University of Toronto, University of Colorado, Lafayette College and University of Pennsylvania. Parts of Doble water wheels for experimental purposes have been furnished to the University of Michigan and Massachusetts Institute of Technology. The University of Michigan has also purchased, for its hydraulic laboratory, the 300-hp tangential wheel, which the Abner Doble Company exhibited at the St. Louis World's Fair, and for which it was awarded the grand prize.

American Electrical Machinery in Foreign Countries.

Japan within a comparatively few years has advanced rapidly in many phases of modern engineering. In the field of electric lighting Japan is particularly well advanced in the matter of equipment. The Nagoya Electric Lighting Company is about to install its second 500-kw Curtis steam turbine for this purpose. The additional equipment includes also a nine-panel switchboard and a small 25-kw horizontal Curtis turbo-exciter set made by the General Electric Company. The last-mentioned machine indicates how closely the Japanese engineers follow American practice even in details. Another country old in civilization is adopting American electrical apparatus for power, lighting and railway work. Note has already been made in these columns of the electrical transmission plans for the Kashmir Valley and another order from India illustrates a different line of work. The Rangoon Trams of Rangoon, Burmah, have 25 General Electric 80 (40 hp) two-motor railway equipments for service on their systems.

In the western hemisphere Mexico represents the same awakening in industrial enterprises, and is rapidly coming to the front. Many mining properties are being extended and electricity is one of the chief factors. In this connection the American Smelting & Securities Company has ordered power house equipment for its Velardena Mines. This apparatus includes two General Electric 450-kw, three-phase revolving-field generators complete with switchboards and exciters. Electricity from the famous Nacaxa Falls power development will be used in Mexico City for lighting, power and railway purposes. The railway lines are operated by the Mexico Electric Tramways, Limited, and this company will also use machinery and railway apparatus built in the United States. The entire equipment for the railway will be furnished by the General Electric Company and will consist of four complete sub-station equipments, generator sets, exciter sets and complete switchboards for each sub-station. The cars will be operated by two-motor and four-motor equipments.

Electrically Driven Grinding Tools.

The British Thomson-Houston Company, Limited, has devoted much attention to the application of the electric motor to machine tool work, and as a result of experience in its own workshops has recently perfected a line of motor-driven emery wheels adapted to any class of work, and suitable for use on any machine tool.

The frame of the motor is cylindrical in form, and is a steel casting with inwardly projecting poles, fitted with removable malleable-iron tips, which serve to hold the field spools in position. The field spools are form-wound and the armature is of the slotted drum-wound type. The brushes are of carbon, and are pressed forward by fingers controlled by springs so arranged as to maintain a constant pressure throughout the wear of the brush. Before leaving the works the motors are subjected to a high potential test by the application of an alternating pressure of 500 volts for one minute.

FIG. 2.—PORTABLE ELECTRIC GRINDER ON BORING MILL.

The motor is provided with a cross slide, the bed of which is cast solid with the frame. A fine feed is obtained by means of a left-hand worm operated by a small hand wheel, and gearing with a rack let into the bed of the slide. A removable tool post is secured in the slide and allows of the grinder being set with its axis at any angle. The slide is amply proportioned and adds greatly to the utility of the grinder, permitting its use with equal facility on any machine tool, either with or without compound head or slide rest.

The grinders are wound for use on circuits of 100 to 125 and 200 to 250 volts, and are made in two sizes. One is specially suitable for use with small machine tools and for light tool grinding, and is rated at ⅛ hp at 2,800 r.p.m. The other is designed for moderately heavy grinding, and is rated at ¼ hp at 2,200 r.p.m.

Compactness, strength and durability are special features of British Thomson-Houston electric grinders, and their general adaptability allows of their economical use on a wide range of work.

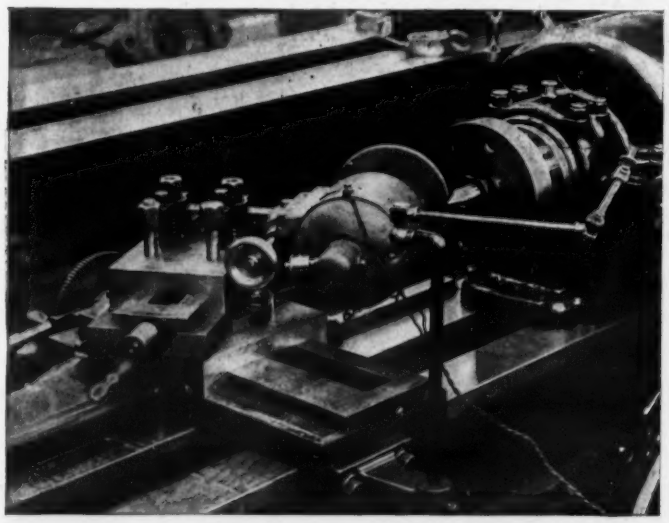


FIG. 1.—PORTABLE ELECTRIC GRINDER ON LATHE.

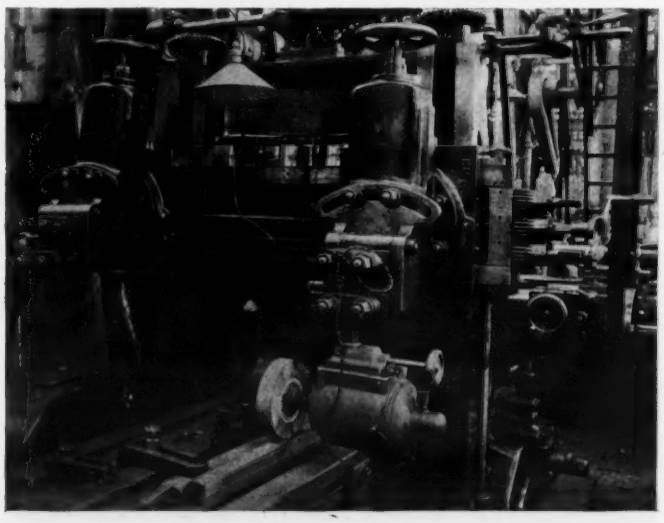


FIG. 3.—PORTABLE ELECTRIC GRINDER ON PLANING MACHINE.

Efficiency Test of Pelton Water Wheels.

A report recently received from a test made upon two Pelton water wheel units by the Nevada Power, Mining & Milling Company, of Bishop, Cal., is interesting as showing what efficiency may be expected from this type of prime-mover when properly designed and erected. The equipment tested consists of two 750-kw generators, each direct-connected to a Pelton water wheel operating at 450 r.p.m., under a static head of 1,065 ft., and transmitting power to the Goldfield and Tonopah districts of Nevada. The water wheels were sold under a rigid guarantee to develop an efficiency of 80 per cent, and a series of exhaustive tests were conducted by the engineers of the Nevada Power, Mining & Milling Company under the following conditions:

The station load was first carried by unit No. 2 and the test made on unit No. 1. The test load was carried by a water rheostat and measurements of the power were made by wattmeters. Readings were also taken by voltmeters and ammeters. The load was constant and the test extended over one and one-half hours. The electric, windage and friction losses of the generator were afterwards obtained by running the generator as a motor. The water pressure was measured by a gauge attached to the pipe just back of the gate, and an allowance was made for the velocity head, which was, however, small at this point. The water was measured by an accurately constructed weir in the tail race. Taking the readings of the wattmeter and adding to it the power necessary to run the generator as a motor, it was found that of the total theoretical power of the water as it entered the nozzle, the wheel delivered to the shaft of the generator 82.8 per cent. The test was made under the supervision of Engineer J. D. Galloway, assisted by the superintendent of the electric plant. A third Pelton wheel of 3,000 hp capacity is now being installed in the same station.

Freight Charges on Old Dynamos.

The Interstate Commerce Commission has sustained the railroads in a recent decision on the complaint of the National Machinery & Wrecking Company, as to charges for freight on an old dynamo; but has suggested changes in the scale or classification. The ruling is an important one as dealing with a large class of electrical apparatus, and is given in full below:

Two questions seem to be presented by this record. First, should the rate on second-hand dynamos be less than that on new dynamos? Second, should the rate on dynamos, when they are only valuable as junk, be the same as on new dynamos? We know of no instance where the rate on second-hand articles, as such, is less than the rate on the new article. There are cases where a lower rate is imposed when a machine is returned for repairs than would be imposed upon a single movement of the machine. The Western Classification provides that when goods which have been shipped to a given destination are for any reason returned, a rate one-half the going rate shall be applied. Under the Official Classification shipments of household furniture, when released to the value of $5 per 100 pounds, take a first-class rate, as against a rate of one and a half times first class when not so released. These instances, and others which might be cited, recognize to an extent the principle that the condition and value of the property may properly be taken into account in determining the classification.

It may also be noted that in the business of handling these second-hand dynamos, the dynamo when shipped from the electric light station to the factory is in the nature of a raw material which is to be converted into a manufactured product. Its value is very much less than that of a new dynamo, and that value depends largely upon the freight rate. In the case before us the complainant paid $85 for this machine and was charged $83.79 for its transportation to Cleveland. Much might be said in favor of a rule which would apply a lower rate to second-hand dynamos when shipped from the electric light station to the repair shop than is charged upon either a new or second-hand dynamo when sent to the station for use; but that is a question of policy for the railroads themselves. This commission cannot say that it is unjust or unreasonable to require the same charge for the transportation of the new and the second-hand dynamo.

The second question is an entirely different one. The dynamo is no longer valuable as such; it has ceased to be an electric machine and has become a combination of copper, brass and iron scrap. Should the same rating be applied to this as to the dynamo?

Under the Official Classification many iron articles in less than carload lots are rated as third class. Most kinds of machinery are second class. Dynamos are first class. Assuming, without expressing any opinion upon that subject, that this rating of dynamos is just and reasonable, it must be upon the ground that the dynamo is a valuable and delicate piece of mechanism which can afford to pay a high rate of carriage and which requires great care in handling. Neither of these things can be affirmed of that dynamo when it has become junk. Its value is no greater than the selling price by the pound of the metal which it contains, nor indeed as great, since a certain amount of labor must be expended before even that price can be obtained. It is apparent that there ought to be some way in which this scrap can be shipped at a less rate than would be applied to the dynamo.

The railroad witnesses state that this can be done; that the tariffs provide a fourth class rate upon iron scrap and a third class rate upon copper and brass scrap; but they further state that in order to obtain this rate the scrap must be presented for shipment in boxes or barrels. In other words, this dynamo must have been broken up at Marietta before it was offered for shipment. The application of such a rule would have prevented the complainant from handling this dynamo or from doing a similar business at other points, and we see no good reason for its enforcement. It was said by the same railroad witnesses that a steam engine, or the flywheel of an engine, or a steam boiler might be shipped at the scrap rate without being broken in pieces, provided it was manifestly of no further use for its original purpose. In the same way, we think it should be possible to ship as junk a dynamo which has been bought for that purpose and which has actually no other value. Such a dynamo need not be boxed nor otherwise prepared for shipment, and it should, of course, bear the rate applicable to the highest class metal used in its construction.

The defendants insist that the application of such a rule would open the door to fraud, and that dynamos which were in fact intended to be repaired and resold as second-hand dynamos would be shipped as scrap. While this objection has some force, we do not regard it as controlling. First, while it is true that railroads are forced to continually guard against misdescriptions of property, we still think that something should be left, in dealing between the carrier and the public, to the good faith of both parties. Second, a dynamo is a delicate piece of mechanism which requires ordinarily careful preparation for its safe transportation by rail. Few shippers would venture to offer a dynamo of much value without such preparation, since the railroad would be absolved from all care in its carriage. Third, the railroad has it in its power to make sure of the good faith of the shipper by requiring the dynamo to be mutilated before leaving the hands of the delivering carrier at destination. It appeared from the testimony that this requirement had on several occasions been imposed upon complainant as a condition of obtaining the scrap rate upon its shipment. Perhaps this might be done before delivery for shipment.

The shipment in question was boxed as a dynamo, and was, as far as could be seen by external inspection, in fact a dynamo. It was described by the Marietta Electric Light Company as "scrap iron," but that company understood that the machine was in fact bought by the complainant as a second-hand dynamo, and that this description was intended to secure a lower rate of freight. Under the circumstances, we think that the defendants were justified in applying to it the dynamo rate, and this complaint will be dismissed; but we also feel that the rules of the carriers should be so modified that the complainant could, had it elected, have shipped this dynamo for what it in fact was, namely, junk. We do not attempt to make any order, for we have no authority to do so, but call this to the attention of the defendants in the hope that they may give it consideration.

Millihour Stop-Watch.

The accompanying illustration shows a stop-watch designed for electrical meter testing work, which has proved to be a successful tool in the hands of the meterman, as it enables him to do away with many calculations and permits the use of testing methods of simplicity hitherto unknown. The watch is non-magnetic and has a running time of .01 of an hou· for the complete revolution of the large hand. The dial is divided into ten divisions representing .001 of an hour or one millihour.

The object of this appliance is to get readings direct in decimal parts of an hour, since the watt-hour is the standard for the measurement of electrical energy.

If a watt-hour meter shows a certain number of watt-hours (revolutions × watt-hour disc constant) in a certain number of millihours, the quotient of both will give the load in kilowatts passing through the meter.

If a given load in watts is applied to the meter for a time of 10 millihours (100 divisions on the watch) it can be arranged

MILLIHOUR WATCH.

so as to compel the disc of a correct meter to complete one, two, three, etc., revolutions in this space of time. The same meter if out of adjustment, for instance, slow, will, under the same load, make the same number of revolutions in a longer time, and the watch will show direct without calculation, in hundredths, the correction factor of the incorrect meter, thus saving time and cutting out all liability to error. This watch, it is said, has found acceptance by a number of California electric companies, and is sold by Mr. Kleinenbroich, Oakland, Cal., and has been brought to our attention by Mr. J. Van der Zande, of the United Railroads of San Francisco.

Round Pattern Direct-Current Switchboard Instruments.

The line of direct-current, round-pattern switchboard instruments made by the American Instrument Company, of Newark, N. J., of which the accompanying cut illustrates the form, are of the movable coil, permanent magnet type. As instruments of this type have been in general use for years, and are universally considered to be most satisfactory for measurements on direct-current circuits, it is not necessary here to dwell upon their principle, and reference will be confined to the specific construction and design of the instruments.

Long previous experience had indicated that the usual method of pivoting movable coils in instruments of this class is responsible for most of the troubles encountered in actual switchboard service; also that a large percentage of the causes which make such instruments defective after being installed and in daily use for any length of time, are due to the cases not being permanently dust-proof. That is, they allow the accumulation of dirt between movable and fixed parts, which tends to obstruct the free operation of the instruments.

Special care is given to pivoting the movable coils of the "American" instruments in such manner that if free of friction when new they will remain so always. This is accomplished by using highly polished cylindrical steel pivots, journaled in the best grade of watch jewels. The mechanical difficulties in producing in this way an instrument which does not show any noticeable friction are greater than if the method of placing conical pivots in conical jewels is used; but when once accomplished an instrument of this kind will remain practically frictionless for many years. In the case of conical pivots, an instrument will seldom show any friction under the first laboratory test, but will develop serious friction as soon as the microscopical point of the pivot is damaged by transportation, by handling in erection, or by the continuous vibration to which switchboards are usually subjected.

The cases of the switchboard instruments are designed so that ample surface is provided where detachable parts are joined, and are guaranteed to be perfectly dust-proof. In this way the vital parts of each instrument are protected efficiently from any accumulation of dirt, which, if present, would interfere seriously with satisfactory operation.

The permanent magnets are made of the best magnet steel obtainable, hardened and aged in accordance with the most improved methods. The movable systems combine lightness with extreme stiffness, and with the method of pivoting used it is claimed to be impossible for the moving coil to come in contact with the pole pieces or core of the magnetic system. By the selection of a proper winding for the movable coils, the instruments are given a somewhat larger torque, which permits the use of stronger controlling springs. Zero errors, so often noticeable in other instruments, are completed avoided. The power consumed in the instruments is stated to be not noticeably larger than that in the best of other makes.

The series resistance in the voltmeters is wound perfectly non-inductive, and all voltmeters have a negligible temperature coefficient. In the ammeters the combination of instrument and shunt is also compensated over a large, and for all practical purposes, a sufficient range of temperature. All voltmeters are adjusted to a uniform resistance per volt, and therefore multipliers can be interchanged. All ammeter shunts are adjusted to the same drop of potential and are also interchangeable. The shunts are constructed to dissipate the heat generated therein in a most

SWITCHBOARD VOLTMETER.

satisfactory way, and will not overheat when run continuously.

The scale opening in the front of the case is considerably larger than the instruments of other manufacture. Thus, more light is admitted to the scale and it can be read more clearly. While back connections are preferable through obviating the necessity on the part of the buyer of drilling holes through the switchboard for leading-in wires, the instruments are also furnished with suitable binding posts. All instruments can be converted into the "flush type" by the mere addition of a special guard ring, easily attachable to a switchboard.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports show that retail trade has, in general, been stimulated by the spring weather conditions; that the winter wheat situation is excellent, and that there is continued activity in nearly all lines of industry. Railway earnings are heavy; bank clearings have increased and there is little adverse effect of the coal miner's partial shutdown. The rush of spring jobbing is now about over, but improved retail demand has already evoked some reorder business, and encouraging reports as to enlarged orders for fall delivery present themselves. *Bradstreet's* reports that the failures for the first quarter of 1906 number 2,791, a decrease of 5 per cent from 1905, and of 2.6 per cent from 1904. Liabilities, while 20 per cent larger than in 1905, are 26 per cent smaller than in 1904. The number of failures during the week ending April 5 was 151, against 169 in the week previous and 170 in the corresponding week last year. Clearings for March (ninety-four cities reporting) aggregate $12,911,071,121, a fraction of 1 per cent gain on March, 1905, despite a decrease of 4 per cent at New York. For the quarter clearings at all cities aggregate $41,535,590,466, a gain of 17.8 per cent over 1905 and of 63 per cent over 1904. The coal strike on April 1 did not cause a total shutdown, except in the anthracite field. In the Pittsburg district half the operators granted the 1903 scale immediately, and the same is true of central Pennsylvania. The Maryland and West Virginia non-union mines continued at work. In Ohio, Indiana and Illinois the shutdown was, however, more marked. Stocks of coal vary with the regions affected. Chicago stocks are said to equal 30 to 90 days' consumption for manufacture, and the railways are said to be well supplied and are handling a record tonnage. Price advances to those in need range from 50 to 75 cents. In anthracite the actual advance is 50 cents, but the failure of the usual spring cut to go in force makes the advance over a year ago $1 per ton. No real pinch is expected in supplies unless the strike lasts a long while, which, at present, does not seem likely. Electric lighting and street railway companies are understood to have taken good care of themselves. Thus the New York Edison Company is said to have 200,000 tons at its Shadyside depot on the Hudson River opposite Manhattan Island. Pig iron is a little more active so far as demand and inquiry go, but prices are probably lower. It is thought that the coal miners' disturbance will occasion little inconvenience unless protracted, as the strike is but partial and manufacturers' stocks are ample, though anthracite furnaces in the East may be affected later on. New business in steel rails is of moderate volume. A heavy business in structural material is in sight. Demand for plates is not so good, but deliveries are heavy. Sheet bars are scarce. Cast-iron pipe is more active and some good business is in sight. In some sections demand for old material has improved, but in others prices are weaker. Copper is steady, but domestic business slightly declined, though over-sea interests purchased more freely. The machinery trade is active, and while the coal miners' trouble does not go unnoticed, it has not interfered with business.

ELECTRIC SERVICE SUPPLIES.—The new Electric Service Supplies Company is a consolidation of the Mayer & Englund Company, of Philadelphia, the Garton-Daniels Company, of Keokuk, Ia.; the Electric Devices Company, also of that place; and Porter & Berg, of Chicago. The new company has been formed with the following officers: President, C. J. Mayer; first vice-president, J. W. Porter; second vice-president, J. V. E. Titus; secretary, Max A. Berg, and treasurer, A. H. Englund. Sales offices will be maintained in Boston, New York, Philadelphia, Pittsburg, Cleveland, Chicago, Atlanta, Birmingham, New Orleans, St. Louis, Keokuk, Kansas City, San Francisco and Los Angeles. The Mayer & Englund Company, of Philadelphia, has been one of the largest concerns in the world devoted to the electric railway supply business exclusively. When the firm was founded in December, 1895, by Chas. J. Mayer and A. H. Englund, it began business by handling the manufactures of the R. D. Nuttall Company and the International Register Company. Shortly afterward the line insulation of the Macallen Company was taken up. At that time the company had two small offices in the Betz Building. To-day the company is the sole occupant of a splendidly equipped nine-story structure, having a 60-ft. front on Filbert Street and a depth of 80 ft. extending through to Commerce Street. The line of materials handled by this company has grown so extensive that only brief mention can be made here of its specialties. These comprise "Protected" rail-bonds; Nuttall gears, pinions and trolleys; Brady bearings, journal boxes, etc.; International registers; Macallen insulation; Sterling varnishes and paints; Lyon sheet steel gear cases, Packard incandescent lamps, and many others. The firm of Porter & Berg was organized by J. W. Porter and Max A. Berg, in 1899, to conduct a general electrical supply business, with headquarters in the Manhattan Building, Chicago. In 1902 larger quarters were taken at 305 Dearborn Street, the entire second floor of which serves for the offices of the company, while the warehouses are located at 45 Plymouth Place, directly opposite. Under the new arrangement these offices and warerooms will now handle all of the Mayer & Englund devices besides the products of the two Keokuk companies mentioned below. These are the Garton-Daniels Company, of Keokuk, Ia., which has done so much valuable work in the development of lighting apparatus and other protective devices, was founded in 1892, and since 1895 has been managed by J. V. E. Titus. In 1901 the Electrical Devices Company was formed in Keokuk by the same interests to push the "Automotoneer," a mechanical device for regulating the speed of controller application. It is intended to use the Keokuk plant of these companies for the manufacture of other products handled by the Electric Service Supplies Company.

NIAGARA TROLLEY BRIDGE.—The Trans-Niagara Bridge Company has been incorporated at Albany for the construction of a bridge to cost $800,000 for trolley service across the river at Niagara Falls 300 feet below the present upper steel arch bridge and connecting the International Railway system on the American side with the McKenzie-Mann-Nicholls system of electric roads in Canada. This will permit the running of through electric cars between Buffalo and Toronto, Hamilton and other Canadian cities and between Rochester and Lockport through Niagara Falls to Hamilton and Toronto. When the new bridge is finished the present upper bridge will be reserved for carriages and pedestrians.

MAGNETITE IRON ORE.—Witherbee, Sherman & Company, Inc., operating the well-known magnetite mines at Mineville, N. Y., have recently shipped carload lots of concentrated iron of over 71 per cent purity to the General Electric Company, Schenectady, N. Y., and to the Monsanto Chemical Works, St. Louis, Mo. Only once have these figures been surpassed when a carload analyzing 71.85 per cent iron was shipped to the General Electric Company. The average iron in the daily output is from 66 to 67 per cent for the purest grade, none falling below 60 to 61 per cent for the lowest grade, with the output of the mines approaching the 900,000 ton per year mark.

TURBINES FOR PARIS.—Ten American turbines and other machines are to be installed in Paris for the purpose of generating electricity to operate a network of street railways in that city. The French Thomson-Houston Company representative of the General Electric Company has secured the contract for all the electrical equipment of these roads. The work involves the installation of the largest steam turbines ever used in France. The contract is worth about $3,000,000. The capacity of the plant will be 80,000 hp.

BELFAST, IRELAND, PLANT.—The fine plant at Belfast, to which special attention was directed recently in these pages, was carried out by the J. G. White & Company, of London, England, who were entrusted with the whole contract. This is one of the largest contracts of the kind done of late in Great Britain, the amount involved being no less than $2,200,000, and the work including power station, track, overhead construction, and other details.

ORDER FOR JAPAN.—The American Trading Company, of New York, recently purchased another 18-in. by 42-in. Reynolds heavy-duty engine from the Allis-Chalmers Company for shipment to Japan.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having just closed a contract with the Kinloch Long-Distance Telephone Company, of St. Louis, Mo., for 10,000 central energy telephones. This is the first order the Kinloch Company placed for new telephones to be used in conjunction with the 17,000-line switchboard now being installed by the Stromberg-Carlson Company. This is one of the very largest installations in the independent field.

KOERTING GAS ENGINE ORDERS.—Since last October the Koerting Bros. Co., Koertingsdorf, Germany, have closed contracts for 17 two-cycle gas engines ranging in size from 300 to 2,200 hp to be installed in various parts of Europe. Several of these are repeat orders, showing the success with which the large gas engine is meeting in Europe.

WIRELESS EQUIPMENT.—The Standard Oil Company has given an order to the Atlantic De Forest Wireless Company to equip the tug *Standard* with De Forest wireless instruments. The *Standard* is engaged in coastwise towing for the Standard Oil Company.

BROOKLYN EDISON IMPROVEMENTS.—The Brooklyn Edison Company proposes to spend this year $3,000,000 in new work and in putting more of its wires underground.

Financial Intelligence.

THE WEEK IN WALL STREET.—Stock prices developed irregular tendencies on the unexpected firmness of money and uncertainty about the negotiations between the coal miners and operators. Manipulative advances were partially successful, but public interest and participation were slight. Stress continues to be laid upon the favorable crop prospects, the activity of business and the excellent earnings of both railroad and industrial properties, yet the condition of the money market is calculated to create conservatism, and it is presumable that large financial interests are not in sympathy with the attempt to mark up stock prices in the face of call loan rates ranging from 6 to 30 per cent. The action of the money market is directly attributable to the enlarged employment and demand for money all over the country, not only in legitimate business channels, but in connection with speculative operations in real estate, which have assumed considerable dimensions and activity at various cities. The United States Steel stocks developed considerable strength, the support given to them being based on assurances that the company will not be placed at any disadvantage as regards its coal supplies by the strike. Amalgamated Copper was more or less of a feature, its advance being accompanied by talk of an increase in the dividend rate. The market for electric securities was weak in the main and most of these stocks are lower. Allis-Chalmers common closed at 21⅝ and preferred at 57⅞, these quotations representing a net decline of ⅜ point in each case. General Electric gained ¾ of a point, closing at 173, and Westinghouse closed at 160, an advance of 1½. The tractions are lower, Brooklyn Rapid Transit closing at 86½, a decline of 1⅞, and Metropolitan Street Railway at 115⅜, a net loss of 2⅜. American Telephone & Telegraph lost ½ point, the last quotation being 139¼; New York & New Jersey Telephone closed at 150, ex.-div., which is a decline of 3¾, and Western Union at 92⅜, this being a gain of ⅛ point. The closing quotations of American Locomotive were 68½ for common and 115 for preferred. On the curb Interborough Rapid Transit closed at 232½, a gain of 3½ points; Interborough-Metropolitan common at 53⅝ and preferred at 89¾, these latter figures being net declines of ⅝ and 1½ points, respectively. Mackay Companies advanced 1½ points net, the closing price being 62½. The closing quotations of April 10 are given in the accompanying table.

NEW YORK

	Apr. 3	Apr. 10		Apr. 3	Apr. 10
Allis-Chalmers Co.	22⅝	20⅝	General Electric	173	166¾
Allis.Chalmers Co. pfd.	59	54⅛	Hudson River Tel.	...	...
American Dist. Tel.	30	...	Interborough Rap. Tran.	232	225
American Locomotive.	70¼	67½	Mackay Cos.	62⅛	61⅜
American Locomotive pfd.	115	114¼	Mackay Cos pfd.	73	72⅛
American Tel. & Cable.	92	91	Marconi Tel.	...	...
American Tel. & Tel.	137¾	138	Metropolitan St. Ry.	118	115½
Brooklyn Rapid Transit.	88⅛	84⅛	N. Y. & N. J. Tel.	...	...
Electric Boat.	27	27	Western Union Tel	91¼	91¾
Electric Boat pfd	65	65	Westinghouse com.	160	156
Electric Vehicle	12	10	Westinghouse pfd.	...	...
Electric Vehicle pfd.	15	16			

BOSTON

	Apr. 3	Apr. 10		Apr. 3	Apr. 10
American Tel. & Tel.	138⅛	139	Mass. Elec. Ry. pfd	68	68
Cumberland Telephone.	...	...	Mexican Telephone	4⅛	4⅛
Edison Elec. Illum.	248	...	New England Telephone	140½	141
General Electric.	173⅞	...	Western Tel. & Tel.	13¾	...
Mass. Elec. Ry.	19⅛	19	Western Tel. & Tel pfd.	90	...

PHILADELPHIA

	Apr. 3	Apr. 10		Apr. 3	Apr. 10
American Railways.	52	52¾	Phila. Electric.	8	7⅞
Elec. Co. of America.	11¼	11⅜	Phila. Rapid Trans.	29	27⅞
Elec. Storage Battery.	78	78	Phila. Traction.	99¼	90
Elec. Storage Battery pfd.	...	...			

CHICAGO

	Apr. 3†	Apr. 10		Apr. 3†	Apr. 10
Chicago City Ry.	...	150	National Carbon.	...	90
Chicago Edison.	...	...	National Carbon pfd.	...	120
Chicago Subway.	...	53½	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd	...	...
Metropolitan Elev. com.	...	26			

† Election Day

HUDSON RIVER TROLLEY TUNNELS.—According to an official statement of the Hudson and Manhattan Railroad Company, the total issue of securities of this company will be $250,000,000. The Hudson and Manhattan Railroad Company will be the operating and holding company of the stocks of the various tunnel and railway enterprises of what are commonly known as the McAdoo tunnel projects. There are two tunnels under the North River nearing completion, the large terminals to be constructed and the connecting railroad in New Jersey and other enterprises which will be directed by this company. There is to be authorized $100,000,000 of four and one-half per cent bonds of which $50,000,000 is to be issued. The bonds are convertible into common stock. This convertible clause necessitates an issue of $100,000,000 common stock to provide for the bonds. In addition, there is to be $10,000,000 five per cent preferred stock, and $40,000,000 of common stock additional.

CHANGE IN WESTINGHOUSE OFFICERS.—At a meeting of the Board of Directors of the Westinghouse Electric & Manufacturing Company held Tuesday, April 10, Mr. L. A. Osborne, formerly third vice-president of the company, was elected second vice-president to succeed Mr. Frank H. Taylor, resigned. Mr. Taylor will retain his seat on the Board of Directors of the company. Mr. Osborne's duties as third vice-president comprised the direction of the engineering and manufacturing activities of the company. As second vice-president he will assume the direction of the commercial branch while retaining those of the engineering department. Mr. Osborne is a graduate of Cornell University and entered the employ of the Westinghouse Electric & Manufacturing Company in 1891, and has successively held the positions of assistant superintendent, assistant to the vice-president, manager of works, fourth vice-president and third vice-president.

TELEPHONE BONDS.—The syndicate which underwrote $25,000,000 of the 4 per cent collateral trust bonds of the American Telephone & Telegraph Company has been dissolved by limitation of time. Delivery of the last $5,000,000 of the bonds was made to it since January 1, of the present year. The syndicate which has underwritten the first $100,000,000 of the new convertible bonds of the company has not as yet placed its holdings. The underwriters are waiting for lower money rates and a better bond market before they bring out the new bond issue.

MARCONI WIRELESS.—The Marconi Wireless Telegraph Company of America issued its annual report recently. It shows $6,190,000 stock issued, and $5,473,364 patent rights, good will and contracts. The report does not show it, but it is understood that the message business during the year was double that of 1904. Over 70 ships are equipped for communication with the Marconi stations, and recent arrangements include 13 steamers of the Cunard, Hamburg-American, North German Lloyd, and French lines. The business in apparatus, etc., is reported as being three times what it was in 1904. During the year one or two of the experimental stations were closed up and written off.

CANADIAN ELECTRIC ROADS.—President Dornville of the Canada Central Railway Company announces that his company has purchased the Irondale, Bancroft & Ottawa Railway Company and the Ottawa River Navigation Company. The Canada Central Railway intends to build an electric line from Montreal to Georgian Bay by way of Ottawa, and the two companies secured will give it valuable franchises.

GERMAN SUBMARINE CABLES.—The annual reports of the German Atlantic Telegraph Company show a profit of nearly two million marks for the year. A dividend of 6½ per cent has been declared.

DIVIDENDS.—The directors of the Bell Telephone Company, of Philadelphia, have declared a regular quarterly dividend of 1½ per cent, payable April 16, as registered April 5.

GENERAL NEWS.

Construction Notes.

TUSCALOOSA, ALA.—The City Council has granted Robert Jemison and associates a franchise for water works, electric light plant, gas plant and a street railway.

MONTGOMERY, ALA.—Charles B. Stark, of St. Louis, Mo., is petitioning for a franchise for the operation of an independent telephone system in Montgomery. The City Council has the matter under advisement.

BIRMINGHAM, ALA.—The stockholders of the Birmingham Railway, Light & Power Company have ratified the action of the directors in deciding to increase the capital stock of the company from $6,000,000 to $7,000,000, so as to provide funds for extensions and improvements.

EUREKA SPRINGS, ARK.—An electric light franchise for ninety-nine years was granted to G. U. Matthews and C. M. Barnes, of this city, by the City Council. In the franchise is a contract fixing maximum rates for lights, which provides a sweeping reduction in prices charged by the Citizens' Electric Company, which has had a monopoly for the past seven years.

PALO ALTO, CAL.—It is stated that bids will be received until April 19 for improving the light and water works plants. J. J. Lewin is superintendent.

ANAHEIM, CAL.—A special election will be held April 14 to vote on a $69,000 bond issue, of which $25,000 will be used for an electric light plant and distributing system.

PASADENA, CAL.—The Pacific Electric Railway Company is planning an extension of its line north on Fair Oaks Avenue, from Montana Street to Mariposa Street, comprising a new route to Altadena.

OAKLAND, CAL.—The capital stock of the Home Telephone Company, of Alamada County, has been increased from $3,000,000 to $7,000,000, according to amended articles of incorporation recently filed.

VALLEJO, CAL.—The California Gas & Electric Corporation is building a power line to supply this city and the Government Navy shops on Mare Island direct from its present trunk system at Cordelia.

SAN FRANCISCO, CAL.—Chief Hewitt, of the Department of Electricity, in his annual report to the Board of Supervisors, estimates the cost of work in connection with underground district No. 4 at $46,409.

SAN BERNARDINO, CAL.—The Sunset Telephone & Telegraph Company will at once build a modern exchange building, place wires underground and make other improvements in the service at a cost of more than $30,000. The new switchboard will have a capacity of 2,000 subscribers.

SAN DIEGO, CAL.—An important transfer of railway and electric lines, involving $546,000 was recorded here recently. All the interests of E. S. Babcock in this city, consisting of trolley lines and a steam railway to La Jolla, were made over to the Los Angeles & San Diego Beach Railway Company.

BERKELEY, CAL.—The town trustees have awarded the contract for the furnishing of electricity for the street lamps and for the town buildings to the Berkeley Electric Light Company (subsidiary to the California Gas & Electric Corporation) at the rate of $6 per street lamp on an all-night schedule, and 50 cents per each interior lamp, with no charge for the lighting of the Town Hall.

SAN FRANCISCO, CAL.—A railroad is to be built from Santa Rosa to Healdsburg and thence up the Dry Creek Valley to the Geyserville and Skaggs Springs wagon road, an estimated distance of 23 miles. The company which has been formed to carry out this project is known as the Santa Rosa & Northern Railroad, and the directors are William A. Cattell, Edwin T. McMurray, J. H. Sandford, P. S. Scales and W. G. Taylor, all of this city. The capital stock is $500,000.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Light Company, owing to the recent disastrous fire in its Station C building on Jessie Street, is spending about $400,000 on a new building and machinery. The building will contain eight 1,000-kw motor-generators, 12 transformers of corresponding capacity, 176 bus-bar compartments, 194 20,000-volt high-tension switches and 173 feet of switchboards, which control all the lights in the downtown district. The building proper will represent an outlay of $100,000 and the machinery about $300,000.

PLACERVILLE, CAL.—The Eldorado Water & Power Company has bonded the property of the El Dorado Water & Deep Gravel Mining Company, and has made the first payment thereon. The company owns exceedingly valuable water rights on the American River, Echo Lake and Sliver Lake, besides minor sources of supply, and a canal 35 miles in length from the American River to Placerville. The purchasing company proposes to combine this system with water rights on the Cosumnes River and crown the undertaking with a large dam on the Cosumnes River at Buck's Bar, seven miles from Placerville with an immense masonry dam which will give 1,100 feet of fall for electric power purposes. Canals will then be extended into Western El Dorado County and Eastern Sacramento County to distribute the water for irrigation purposes.

STOCKTON, CAL.—It is stated that arrangements are being made by the American River Electric Company to construct a large steam power plant in this city to supply customers with power when there is a break in the line between here and the hydro-electric plant near Placerville. The company has had much trouble owing to heavy rains washing out a portion of the flume or other portions of the plant. With an auxiliary plant here there would not be much interruption in the service. A second pole line from the power-house on the American River is also being constructed. Should both lines be useless the plant in Stockton will furnish the power for the entire circuit. The machinery has been ordered and it is estimated that the total cost will be about $250,000. The aggregate cost of all the changes outlined, including the steam system, will be $400,000.

LOS ANGELES, CAL.—A $1,000,000 contract was awarded in Los Angeles recently for the erection at Redondo of one of the largest steam power plants west of New York. The increasing need of the Los Angeles Railway Company for more power to operate its lines is one of the main reasons for the enterprise. Sufficient power will be generated, however, to supply an enormous demand aside from that of the Los Angeles Railway Company. The parties to the big contract are the Pacific Light & Power Company. The power to be generated is placed at 25,000 hp, and the amount named for steam and electric equipment is something more than $1,000,000. Added to this will be the cost of the building that is to house the machinery. This figure is placed at $250,000, making the total cost of the plant about $1,250,000. Work on the plant will begin within sixty days, and it is hoped that the plant may be placed in operation in a year.

DENVER, COLO.—Work on the construction of the Denver-Southeastern Railway Company will possibly begin on or about April 15.

COLORADO SPRINGS, COLO.—The city of Colorado Springs will soon be asked to grant a franchise to the Colorado Springs & Interurban Company for a line on Kiowa Street to connect the Wahsatch Avenue and Institute Street lines. Citizens have signed a petition, but action on it will be delayed pending an agreement with the Santa Fe Railway Company and the street car company for the construction of a loop on railroad ground. The street car company has offered to pay one-third the cost of constructing the Costilla Street conduit, work upon which has already begun.

WALLINGFORD, CONN.—Plans are under consideration for extending the present electric plant of the borough. An appropriation will be voted from the accumulated surplus earnings from the operation of the Borough Electric Works to meet the cost of the proposed improvements.

BROOKLYN, CONN.—The Connecticut Railway & Lighting Company has submitted an agreement to extend its railway to this town and Town Plot, but the terms were not altogether satisfactory to the town committees, and the matter has been held over for further consideration.

BRIDGEPORT, CONN.—Plans are being prepared for the construction of a large new power plant for the Wheeler & Wilson Manufacturing Company. The object is to concentrate the power used in the various buildings of the extensive plant. The new power station will be equipped with vertical direct-connected engines, having a combined capacity of 1,200 hp. The new station will be so constructed that the output can be increased at any time it is deemed necessary.

MIDDLETOWN, CONN.—The contract recently made by the city with the Middletown Electric Light Company to furnish the city with electric lights for a term of three years, went into effect April 2. By its terms the company is to furnish 105 arc lamps and 11 series lamps. The contract price for the arc lamps is $92 a year for each lamp and $18 a year each for the series lamps. This means a saving to the city of approximately $1,000 a year over the price paid under the old system.

GROTON, CONN.—The new power plant of the borough of Groton is nearing completion. In view of the early completion of the building the contract has been let for moving some of the equipment at the old power house to Groton borough. The smoke stack and boilers are included. The contract has been awarded to John Woodmansee of Norwich. The Poquonoc plant will be run by water power and the old gasoline engine during the remainder of its life. Unless some unforeseen accident should cripple both sources of power there will be no lessening of the efficiency of the service.

MANCHESTER, CONN.—The matter of the unsatisfactory system of lighting in the places of business and residences at the north end of the town has been brought to the attention of the officials of the Manchester Light & Power Company, who have charge of the lighting system in that section, and it is understood that they have plans under consideration whereby the situation is soon to be relieved. If their plan is carried out it will mean that a large number of meters will have to be installed. The power for the local company is now generated at the station of the tramway company, and should any of the talked of changes there take place it is quite likely that the Manchester Light & Power Company would arrange to supply its own power.

WILMINGTON, DEL.—The Brandywine Gas & Electric Company, to supply gas and electric currents in Wilmington, Del., has applied to the Street and Sewer Department of that city for the right to do business there. The incorporators are Messrs. William H. Fuhr, Jr., William L. Hahn, John M. Patterson, William H. Sutton and John Herbert. The concern is capitalized in $100,000.

DOVER, DEL.—The Middletown & Odessa Trolley Company, running a line between Middletown and Odessa, is negotiating for a right of way for the extension from Odessa to Delaware City, the present terminus of the New Castle & Delaware City Company. If this line is extended to Delaware City, it is probable that the Smyrna & Delaware Bay Traction Company will extend its line to Middletown, thus giving a continuous service from Wilmington to Smyrna and then to Dover.

MACON, GA.—The Macon Railway & Light Company has decided to build a three-mile extension to Summerfield.

ALBANY, GA.—At a meeting of the Albany Business League a resolution was adopted that a committee immediately take up the matter of the city ownership of an electric railway system, the power to be brought from Big Shoals.

WAYCROSS, GA.—J. E. Dempsey will apply for a franchise for the Waycross Electric Street Railway, Light & Power Company, and if the franchise is granted the company agrees to begin work on an electric line during the present year.

COLUMBUS, GA.—The new Columbus Power Company has acquired all the property lying along the river nearly to West Point, and now practically controls the river front for a distance of 26 miles. Important developments are looked for in the near future.

CHICAGO, ILL.—The Chicago Edison Company and the Commonwealth Electric Company have decided to expend about $4,500,000 in improvements. Samuel Insull, of Chicago, is president of both companies.

WAUKEGAN, ILL.—Wetherson, Eglar & Co., of Chicago, have secured the contract for constructing the central power plant of the North Shore Electric Company, Samuel Insull, of Chicago, president. It is stated that a substation will be erected at Lake Bluff, at a cost of $25,000.

CRISMAN, IND.—The Portage Telephone Company has increased its capital from $10,000 to $30,000.

HUNTINGBURG, IND.—The Dubois County Telephone Company will increase its capital stock from $20,000 to $25,000.

INDIANAPOLIS, IND.—The Pike County Telephone Company will increase its capital stock from $25,000 to $40,000.

SOUTH BEND, IND.—The St. Joseph County Commissioners have granted a ninety-nine year franchise to the Kalamazoo, Elkhart & South Bend Traction Company.

WAVELAND, IND.—A company, headed by A. P. Hanna, will soon ask for bids for the furnishing of a switchboard, wire and the construction of a telephone plant in this place.

KOKOMO, IND.—C. A. Jay, general manager of the Citizens' Telephone Company, is asking for bids for the furnishing and putting in of about $15,000 worth of underground and overhead cables.

EVANSVILLE, IND.—The City Council has voted to create a city ownership fund. The ordinance provides that the $12,500 recently received from the Cumberland Telephone Company should be used in starting the fund.

WABASH, IND.—The Home Telephone Company is preparing to construct a new business block to be used for the company's exchange. The company will soon be in the market for a new multiple switchooard of the latest type.

TERRE HAUTE, IND.—The Board of Public Works and City Council have made a five years' contract with the Terre Haute Light and Traction Company for street lighting. The price is $70 per lamp per year. This action puts an end to the municipal lighting scheme that has been advocated for a year or more.

EVANSVILLE, IND.—A mortgage for $550,000 has been signed by the directors of the Evansville & Eastern Traction Company to cover a bond issue for that amount to the Pittsburg Bond Company, which will furnish the necessary capital for building the road from Newburg to Rockport. The road is capitalized at $1,500,000.

HARTFORD CITY, IND.—A. B. Trentman, of Ft. Wayne, is asking the City Council for a franchise to supply electric light and power to business houses of this city. Mr. Trentman is building paper mills in this city and it is his plan to make the plant generate sufficient power to operate the mill and give merchants power for both day and night service.

RICHMOND, IND.—The proposition to sell the municipal electric light plant has aroused considerable feeling in this city and an intimation of graft. The Council has appointed a committee to investigate and bring in a report as to the actual cost of the plant to date. It is understood that the Light, Heat & Power Company, which has operated in Richmond for a long time, is to be the purchaser. The proposition embodies an agreement to organize a new company under the laws of Indiana, which shall not only take over and absorb the municipal plant at cost, but which shall take over the holdings of the private company. The matter will be referred to a vote of the people. Richmond's municipal ownership experiment has been an interesting one from many standpoints. Mayor Zimmerman has been an enthusiastic advocate of municipal ownership of lighting from the start, but he now says that the competition has cheapened the service, nothing more can be gained, and therefore he is equally enthusiastic for the sale of the plant. The report of the committee is awaited with interest.

MARIETTA, I. T.—G. Saeger, of Rich Hill, Mo., has secured the contract for constructing water works and an electric light plant in this place for $25,144.

NOWATA, I. T.—The City Council has granted a 20-year electric light and power franchise to H. I. Strother of this city. Mr. Strother has agreed to have the plant completed within six months.

MUSKOGEE, I. T.—W. L. Reeves, of Muskogee, writes that he has just received a franchise for an electric light plant. A company is being organized and it is expected to be ready to construct light and power plant within a year.

DECORAH, IA.—The citizens have voted to grant a franchise to the Upper Iowa Power Company.

DES MOINES, IA.—The Des Moines, Winterset & Creston Interurban Railway has been granted a franchise in both Creston and Macksburg. The town of Winterset voted on a franchise to this company at a special election held the latter part of February and defeated it. The company has arranged to go around Winterset, running a spur into the town from the northeast corner of the city limits, and having its own right of way around the north and east of town. The surveys have been made and the plans are now being figured out. The line contemplated is but little more than sixty miles in length and is one of the shortest possible routes between this city and Creston.

FRANKFORT, KAN.—E. C. Dunham has installed an electric lighting plant operated by a gasoline engine.

TOPEKA, KAN.—The City Council has passed a resolution providing for enlarging and rebuilding the electric light plant.

TROY, KAN.—Louis Bender, who has secured a franchise in Highland, will also ask for an electric light franchise in Severance, Troy and Wathena.

ARKANSAS CITY, KAN.—James Tuttle, of Geuda Springs, is preparing to make some extensive improvements at the springs this summer. Among the improvements planned are the installation of a 15-hp engine that will supply 200 electric lamps.

BELLEVILLE, KAN.—John B. Peach, City Clerk, writes that the citizens voted on April 3 to construct an electric light plant at a probable cost of $20,000. Bids for construction will be received about May 1. Engineer, W. K. Palmer, of Kansas City, Mo. J. E. Caswell, Mayor, either of whom may be addressed.

SCAMMON, KAN.—A franchise has been granted to the Weisbach Light Company. The company is to maintain an all-night light service of 50 lamps in the city for a period of ten years commencing May 1, 1906. The cost of the service, it is stated, will be $22 per year for each lamp.

HUTCHINSON, KAN.—The machinery, lights, etc., contracted for by the new electric company, are said to have amounted to about $40,000 all together. The dynamos and much of the machinery was purchased from the Allis-Chalmers Company, of Milwaukee. The lamps were purchased from the Fort Wayne Electric Company.

ELDORADO, KAN.—Eldorado will soon be lighted by electricity. The City Council has granted a franchise to a home company which will put in the plant together with a cold storage and ice factory. The franchise granted to C. D. Resler and assigns conveys the right to erect, maintain and operate a gas and electric lighting plant in the city for a term of twenty years.

WICHITA, KAN.—The Wichita Light & Power Company is soon to make some improvements in its plant on Waco Avenue. Henry C. Scott, a St. Louis capitalist and the owner of the gas and electric plant, has been in the city recently looking after his interests and preparing to make certain changes. The company has secured a plot of ground 140x200 feet just north of the Missouri Pacific depot and just east of the gas plant, where it is planned to erect several new buildings. However, the plans of but one are finished. It will be a fireproof stone building, with a tile roof and will be 140x40 feet.

GARDEN CITY, KAN.—Specifications are on file at the office of THE ELECTRICAL WORLD, 114 Liberty Street, New York, N. Y., for furnishing and installing near Garden City, an electric power plant of 450-kw switchboard output for pumping purposes, including boilers, engines, generators, switchboards, etc., bids for which will be received at the office of the U. S. Reclamation Service, 876 Federal Building, Chicago, Ill., until May 28. O. H. Ensign, electrical engineer, 321 Merchants' Trust Building, Los Angeles, Cal.

MADISONVILLE, KY.—Bids are wanted until May 1 for constructing an electric light plant for this city, at a cost of $25,000 to $30,000. Address W. C. Morton.

LOUISVILLE, KY.—The Louisville Lighting Company has decided to expend about $300,000 in improvements in its plant at 14th and Magazine Streets. It is proposed to install a turbo-generator capable of generating 3,000 kw.

LOUISVILLE, KY.—The Board of Public Works has been empowered to draft a contract with the Louisville Lighting Company to light the city at a reduction of $10 per light less than the rate in force heretofore. The contract is invalidated if the city grants privileges to any other company.

CHARLESTON, KY.—Clarence R. Hay, owner of the electric light plant at Charlestown, has transferred the lot on which his plant is located to the Louisville and Northern Railway & Lighting Company for a nominal consideration of $1. With the lot goes a franchise for street

lights and service with private individuals. Only the favorable weather is now awaited before actual construction work on the line is begun. The line to Charlestown will leave the Sellersburg line at Watson, from which point there is a natural roadbed to Charlestown. The Charlestown electric plant, will be very much improved, it being the intention to increase the capacity sufficiently to furnish operating power for the extension of the interurban.

NEW ORLEANS, LA.—Surveys have been made for an electric railway that it is proposed to build from New Orleans to Brookhaven, Miss., a distance of about 100 miles. The line, as surveyed, parallels the Illinois Central. It is said that the purpose is eventually to extend the line to Jackson, Miss., and that it is one of a system of interurban electric lines that are projected in Louisiana and Mississippi. Attorney Ray, of Ponchatoula, is representing the promoters.

WESTBROOK, ME.—The Westbrook Electric Light & Power Company has completed the extensive alterations in its plant and system, which have been under way during the past three years, and has a thoroughly equipped and modern plant.

BRUNSWICK, ME.—The new directors of the Lewiston, Brunswick & Bath Electric Railway, the control of which recently passed to a syndicate headed by John R. Graham, of Bangor, have voted $125,000 for improvements and extension.

PEMBROKE, ME.—C. F. Gardner, Box 603, Belfast, England, of the Pembroke Power Company, writes that it is proposed to construct a power plant at Pembroke, to supply power to the Eastport Electric Light Company to include 15 miles of transmission line and two 150-kw units. Bids for construction will be received about May 15; the cost complete is estimated at $35,000.

HYATTSVILLE, MD.—The Council has authorized the City Treasurer to procure bids for the purchase of $12,000 bonds, to be used for the installation of the proposed municipal electric light plant.

HYATTSVILLE, MD.—An election will be held April 21 to vote on granting the Hyattsville Gas & Electric Lighting Company, a franchise for a gas plant.

MANSFIELD, MASS.—Plans for an extensive addition to the municipal electric light plant, which will almost double its capacity, are about completed.

ORANGE, MASS.—It was erroneously stated in a recent issue that Mr. E. O. Horton is manager of the Orange Electric Light Company. Mr. A. W. Hubbard is filling this position.

BYFIELD, MASS.—It is said that a system of electric lighting is to be inaugurated here in Byfield by which places of business, homes, etc., may be lighted at a low cost. Private capital is said to be behind the enterprise.

PEABODY, MASS.—At a recent town meeting it was voted to indefinitely postpone action on the proposition to appropriate $27,000 for improving the electric light plant, as it was not believed that sum would be sufficient for the purpose. An appropriation of $200 was made to employ an expert to report upon the condition and needs of the plant.

MIDDLEBORO, MASS.—At the recent special town meeting, the special committee appointed one year ago to investigate the municipal electric and gas plants made its report, recommending new machinery to cost $18,000 for the electric plant, new gas mains to cost $2,750, and new gas meters to cost $1,250, involving a total expenditure of $22,000 by the town.

MAYNARD, MASS.—The residents of South Acton have sent a petition to the American Woolen Company, asking that a charter be secured which will allow the company to extend its electric lighting service from Maynard to South Acton, so that electric lights may be put in operation there. If that is done, the South Acton people have a proposition to make to the woolen company for furnishing electric lights for a term of years.

MEDWAY, MASS.—It is understood that the Edison Electric Illuminating Company will commence work in a few weeks stringing high-tension wires from Dover to the power plant at Medfield Junction, which now furnishes power for the towns in this section, including Walpole and Sharon. The manufacture of electricity will then be discontinued at the Medfield plant, and the machinery there will be removed. However the power plant will be used as a sub-station and a number of converters will be installed.

WESTFIELD, MASS.—Work on the new dam and power house at Russell that is to supply power for the Western Massachusetts Street Railway, is nearing completion and it is planned to have it ready for use about May 1. The generators are in the center of the dam, in a small enclosure that has been built in the concrete. The generator room is reached by an alley way directly under the dam, so that those who have occasion to go to it have to go directly under this body of water. It is estimated that there will be about 600 hp developed.

SOUTH DARTMOUTH, MASS.—At a regular meeting of the Improvement Society, H. K. Wilson presented plans for establishing an electric lighting plant. Mr. Wilson estimated that it would cost about $20,000 for a building, dynamos and machinery. The proposed system was to light the houses and streets from the head of Apponegansett River to Salters Point. Mr. Wilson proposed a stock company be incorporated, consisting of the inhabitants of this vicinity. The proposed plant is under consideration by the society and the matter will be acted upon in the near future.

LEOMINSTER, MASS.—The Fitchburg & Leominster Street Railway Company has purchased from B. P. Cheney, George H. Richardson and others the Mordant chemical works in Shirley. The purchase includes 14 acres of land, a one-story brick building and chimney, and a water privilege with 11 feet of fall and an inexhaustible supply, and large flowage privileges. Two turbine water wheels are now installed. Engineers are at work on plans for developing the water power and the street railway officials expect to get 200 hp from the privilege, The present power station at South Fitchburg will not be disturbed for some time, not until the completion of the new power station at Mitchellville, if at all. It may be kept intact, as an emergency station. The car barns at South Fitchburg will not be disturbed.

CHARLEVOIX, MICH.—The citizens have voted to issue $16,000 bonds for the extension of the light and water plant.

SAGINAW, MICH.—The electors on the tax rolls are to vote on the question of bonding for $150,000 to establish a municipal electric lighting plant.

HANCOCK, MICH.—The Keweenaw Copper Company has decided to developed the water power of Mosquito Lake, and construct a dam and power plant.

SAGINAW, MICH.—The proposed power plant to be constructed by the Rifle River Power Company will cost about $250,000. H. von Schon, of Detroit, is engineer.

PONTIAC, MICH.—The proposed power plant to be constructed by the Clinton River Power Company at Pontiac will cost about $120,000. H. von Schon, of Detroit, is engineer.

GRAND RAPIDS, MICH.—The Grand Rapids, Grand Haven & Muskegon Railway Company is receiving current from the Grand Rapids-Muskegon Water Power Electric Company at the power house at Fruitport.

JACKSON, MICH.—Within the next few weeks the Michigan State Telephone Company will begin extension and improvement of the local service. This spring and summer 26,650 feet of aerial lines are to be added to the overhead system and 6,835 feet of additional cable placed in conduits. In all the company will spend $15,000 on local improvements.

YPSILANTI, MICH.—Work on the improvements of the Michigan Telephone Company will soon begin. Seven cars of material have arrived, two double cars and one single car of poles and two cars of cable. The cable will be used for underground work and as the ground is in good shape to start it is expected that the company will begin work soon. The improvement will include not only a new up-to-date switch board, but also the laying of a great deal of cable and the setting of many poles. The work, when completed, will have cost in the neighborhood of $40,000.

TYLER, MINN.—John Anderson and Wm. Holmes, of Tyler, are interested in the construction of an electric light plant.

TWO HARBORS, MINN.—F. E. Evans, City Recorder, writes that it is proposed to install a 40 to 50-kw, 60-cycle, single-phase alternator.

ST. CLOUD, MINN.—The Granite City Railway Company, the only bidder at the sheriff's auction, bought out what was known as the Benton Power & Traction Company for $35,748.47.

CANNON FALLS, MINN.—We are informed that the date of receiving bids for the proposed power plant on Cannon River, has been postponed from April to June 1. H. von Schon, 34 W. Congress Street, Detroit, Mich., is the engineer.

BIWALIK, MINN.—F. M. Butler, City Recorder, writes that it is proposed to construct new sewers and purchase new dynamo, etc., for the electric light plant, at a total cost of $25,000. McGilvray & Patton, of Duluth, are the engineers. Bids will be received until May 1 for $5,000 bonds for making the additions to the electric light plant.

CARROLLTON MISS.—The Carrollton Electric Light Plant was sold here recently by the Bank of Carrollton to satisfy a mortgage held by the bank for $8,500. The plant was erected some three years ago at a cost of about $18,000.

YAZOO, MISS.—Plans are making to build a street railway at Yazoo. Mayor E. R. Holmes and Messrs. W. F. Cummings and E. P. Swain, who were appointed as a special committee by the City Council, were in Jackson a few days since and made an inspection of the local street railway system, going from here to New Orleans, where they gathered additional information on the subject.

ST. LOUIS, MO.—A deed transferring the holding of the Malvern Water & Improvement Company, of Greenwood, to the West St. Louis Water & Light Company, was filed for record at Clayton, St. Louis County, April 5. The consideration named was $1,400. The Malvern Company was organized for the purpose of supplying Greenwood with water from the city of St. Louis. The purchasing company, it is said, will connect its mains with those of the Malvern Company and supply Missouri River water.

JEFFERSON CITY, MO.—At a conference held April 2 between J. W. Mellor, of Sedalia; W. B. Kerns, of Bunceton; Henry Fricke, of Prairie Home; W. C. Fink, of California, and C. W. Thomas, of Jefferson City, representing the cities along the route of the proposed interurban railway from Jefferson City to Sedalia and H. B. Colby and H. H. Humphrey, of St. Louis, a contract was entered into with Messrs. Colby and Humphrey to make the preliminary survey for the line. It was stipulated that the survey must be completed and the profiles and blue prints submitted within sixty days. Messrs. Colby and Humphrey say that a sur-

vey party will be placed in the field at once. The length of the proposed line is about eighty miles.

TWIN BRIDGES, MONT.—Electrical power will be used for operating the great dredge which is now being constructed by the Conrey Placer Mining Company. A power line is now being erected across the range from the plant of the Madison River Power Company, in the Madison Valley, and will be in readiness to transmit power before the first of June.

KEENE, N. H.—To further increase the capacity of its power plant, the Citizens Electric Company recently ordered another producer of 250-hp, a gas engine of 165-hp, together with an electrical generator of 110 kw. When the work of installing these machines is completed, the capacity of the plant will be 500-hp for the producers, and 415-hp for the generators and engines. The company has recently installed two 75-light constant current tub transformers for the street light circuit. Previous to this two 50-light transformers had been operated continually since last November on a 20 per cent. overload, and while giving satisfactory results, it was deemed expedient to put in additional transformers now, rather than later.

BORDENTOWN, N. J.—The City Council has decided to procure new bids for lighting the city for one, three and five years.

HARRISON, N. J.—The Public Service Corporation has secured the contract for lighting the town for five years at $85 per lamp per year.

ELIZABETH, N. J.—The Aldermen have granted an amended franchise to the Essex Cross Railway Company to enter the city and connect with the Public Service Corporation's lines. The new road will run through part of Union and Essex Counties to Irvington.

ATLANTIC HIGHLANDS, N. J.—The Borough is preparing to advertise for bids for furnishing equipment for the remodeling of the electric light and water plant of the municipality. The bids are to be received for the entire work or any part of the alterations, and specifications can be seen as soon as the advertisement of the bids is arranged for, either at the office of the borough clerk at Atlantic Highlands or at the office of Alexander Potter, 143 Liberty Street, New York, who is the consulting engineer. The equipment needed includes one 150-hp cylinder engine for direct-connection to a 100-kw alternating-current generator not to exceed 277 r.p.m.; two 150-hp single-cylinder engines for direct-connection to two 100-kw alternating-current generators; two compound 150-hp engines direct-connected to two 100-kw generators; one 100-kw revolving field or induction type belted generator, to be used on an engine now installed; two 100-kw generators direct-connected to one 125-hp horizontal return tubular boiler and one air compressor capable of delivering 175 cubic feet of free air per minute at a working pressure of 60 pounds to the square inch.

LITTLE FALLS, N. Y.—The Hudson River Electric Power Company, of which Bryce E. Morrow, of Glens Falls, is manager, has made application to the City Council for permission to enter Little Falls.

BROOKLYN, N. Y.—The Edison Electric Company, of Brooklyn, of which W. W. Freeman is manager, has decided to expend $3,000,000 this year in placing its wires underground, and extending the underground system.

TROY, N. Y.—A hearing will be given before the Cities Committee of the Senate on the bill which permits the city to issue bonds to the amount of $500,000 for the purpose of establishing a municipal electric lighting plant.

FULTON, N. Y.—The Fulton Light, Heat & Power Company, of which Louis W. Emerick is superintendent, has decided to install a 600-hp horizontal turbine, a 300-kw generator and a complete outfit of switchboards, exciters, etc.

RHINEBECK, N. Y.—The Governor has signed the bill extending for one year the corporate existence of the Rhinebeck-Rhinecliff Railway. This is the concern in which Robert H. Hunter, deputy insurance superintendent, is interested.

SYRACUSE, N. Y.—At the meeting of the Board of Directors of the Independent Telephone Company a budget involving the expenditure of between $200,000 and $300,000 in spring and summer development work in this city and in the Central and Northern New York territory was adopted.

PHŒNIX, N. Y.—The Phœnix Fuel, Light and Water plant of Phœnix has been purchased by New York capitalists at a price said to be about $150,000. It has been suggested that power will be obtained from the new owners for the proposed trolley extension of the Lakeside line from Baldwinsville to Fulton.

LOCKPORT, N. Y.—The Economy Light, Heat, Power and Fuel Company is soliciting contracts for electric light, heat and power at rates about 25 per cent. below those of the Lockport Gas and Electric Light Company, which at present has the local field to itself. The new company was granted a franchise some time ago. The contracts state that power will be furnished to consumers about September 15. Charles R. Bishop, an officer and director, states that he expected the company would be ready for operation before that time. A large electric station will be erected on the west side of Elm Street on the site of the old steam company heating plant.

FARGO, N. D.—The Northwestern Telephone Exchange has purchased the telephone lines of the Red River Telephone Company, of Moorhead, Minn. The new additional line has over one hundred subscribers and will be considerably improved. There are now 176 miles of poles with 600 miles of wire. With the farm telephones installed by the company and their connections with farm lines, 1,000 subscribers are added to the Fargo exchange.

PAULDING, OHIO.—The City Clerk writes that it is proposed to construct an electric light plant, at a cost of $10,000.

LIMA, OHIO.—The Lima Telephone & Telegraph Company has increased its capital stock from $250,000 to $300,000.

HUNTINGBURG, OHIO.—Dubois County Telephone Company, of Huntingburg, has increased its capital stock from $20,000 to $35,000.

LIMA, OHIO.—The Lima Railway, Light & Power Company has agreed to furnish the city with power at 3 cts. per kw-hour until such time as the city plant can be installed.

MT. VERNON, OHIO.—The Mt. Vernon Telephone Company held its annual meeting recently. During the year the company installed 700 new telephones and it is now planning to make important improvements.

CLEVELAND, OHIO.—At a meeting of the shareholders of the Aurora, Elgin & Chicago Railway Company at Chicago, it was voted to issue bonds in the amount of $25,000,000 for the purpose of completing, improving and operating its existing lines.

COLUMBUS, OHIO.—The Council is considering a proposed bond issue of $140,000 for the purpose of improving the municipal lighting plant. The plant may have to remove 500 arc lamps unless the additional equipment is secured, as it is heavily overloaded.

UPPER SANDUSKY, OHIO.—A franchise was granted by the Council to J. J. Barber, of Toledo, representating the Findlay, Carey, Upper Sandusky & Marion Electric Railway Company, to construct a line through this city connecting with the Marion-Columbus line at Marion and the Toledo-Findlay line at Findlay.

AKRON, OHIO.—The Stark County Commissioners are having estimates prepared on the cost of installing a lighting and heating plant in the court house to supply the county buildings. Under the present arrangement it costs $3,000 to light and heat the buildings and it is believed this could be greatly reduced if the county had its own plant.

MARION, OHIO.—The Erie Railroad is preparing to erect large repair shops at Marion, and it will install a large electric power plant which will furnish power and light for all the machinery in the various buildings, operate all switch lights and block signals within the yards and operate the fuel and ash conveying outfits for the roundhouses.

CANTON, OHIO.—A ten-year contract for electric lights has been let by the Board of Public Service to the Canton Light, Heat & Power Company. The contract is for 54 lamps, to burn every night, at $64 per lamp per year, and 267 lamps by the moonlight schedule at $44 per lamp per year. The Merchants' Heat, Light & Power Company intimated that it would make a bid, but it did not do so.

DAYTON, OHIO.—The ordinance granting the Dayton Citizens' Electric Company a franchise has been passed in its amended form. Plans for the company's plant are already being prepared, it is said. Several sites are being considered, but none has been definitely decided upon as yet. The plant will be erected, no doubt, where railroad facilities are easily accessible, and it is said that the work will be pushed rapidly to completion when a location is determined upon.

BLACKWELL, OKLA.—Blackwell Electric Light & Power Company will begin operating a power and fan circuit this season. Garrett Waite is president.

ROGER MILLS, OKLA.—The Western Oklahoma Telephone Extension Company has sold all of its interests to the Pioneer Telephone & Telegraph Company.

BAKER CITY, ORE.—H. H. Andrews is making contracts for the Oregon Electric Company for the installation of a 6,000-hp electric power plant in the Eagle Valley during the coming summer. He is considering the matter of using electric power for pumping for irrigation purposes.

PORTLAND, ORE.—A. M. Drake reports that California capital will interest itself in power development along the Deschutes River from Bend to Benham Falls. The plans are said to include the installation of powerhouses at Bend, Benham Falls and other points along the Deschutes, and the operation of electric railways and manufacturing plants on both sides of the Cascade Mountains. F. S. Stanley is secretary and treasurer of the Deschutes Irrigation & Power Company.

PORTLAND, ORE.—The Portland General Electric Company will expend $2,000,000 in a new office building in Portland, the reconstruction of the city's lighting equipment, new arc lamps, and the installation of an additional power plant to be known as Station A at Oregon City. When the plans now forming are carried out the company will control upward of 90,000 hp, including output at its Portland steam plant, the present plant at Oregon City and the new plant to be built there, and the surplus of 7,000 hp to be delivered to the company by the Oregon Water Power & Railway Company.

SANGER, ORE.—The Eagle River Electric Power Company, of which J. K. Romig, of Baker City, Ore., is manager, will erect a 1,200-kw hydro-electric power plant on the Eagle River, near Sanger, to supply power to mines.

PORTLAND, ORE.—The Oregon Water Power & Railway Company, Portland, Ore., intends to construct additional shops, which will be operated by electricity. The equipment has been secured.

TOLO, ORE.—Condor Water & Power Company is installing new units, a 750-kw machine having just been put to work with the one already in. It is a machine of the G. E. revolving field type. The plant is operated by water power. F. F. Loder is foreman of the sub-station.

NEW HAVEN, PA.—The Town Council is considering the question of constructing an electric light plant.

DARBY, PA.—The Philadelphia Suburban Electric Light Company has secured the contract for constructing an electric light and power plant.

SUNBURY, PA.—It is stated that bids are about to be received by the Middlecreek Electric Company for the construction of a dam and power house.

GIRARDVILLE, PA.—Fire destroyed the power house and barn of the Schuylkill Railway Company, April 3, entailing a loss of $50,000. Thirteen cars were consumed.

ALTOONA, PA.—Charles F. Vogel, 1515 First National Bank Building, Chicago, Ill., is secretary of the Bedford Water & Electric Company, which proposes constructing a power plant in Bedford County, to cost about $150,000.

PITTSTON, PA.—Edward J. Rutledge, representing the Pittston Light, Heat & Power Company, about to be incorporated, is stated to have secured the contract for lighting the city for five years at $50 per year for enclosed arc lamps, and $17 per year for incandescent lamps.

YORK, PA.—The franchises and property of the York Street Railway Company have been sold to Brown Brothers, bankers, of Philadelphia. Under the new ownership the trolley system will be extended throughout the county connecting all the towns, boroughs and villages of any importance. In addition to the railway lines the Edison Electric Company, the Westinghouse Electric Light Company and the York Steam Heating Company are owned by the York County Traction Company, which has also been acquired recently by the new interests.

SALT LAKE CITY, UTAH.—Part, if not all, of the electrical equipment for the three complete hydro-electric plants, to be installed by the Inter-Mountain Power Company, Salt Lake City, will be purchased in New York City. James J. Chambers, president of the company, will be at 912 Harrison Building, Columbus, Ohio, during the month of April, and will also visit New York for the purpose of purchasing the electrical equipment. One station will consist of four 750-kw units, another station will consist of two 600-kw units and a third station will consist of a 500-kw unit. Impulse wheels will be used. A fourth unit of 750-kw capacity will be installed next year, and work will be begun during the fall on a steam plant to comprise two 500-kw units.

SOUTH RYEGATE, VT.—A local electric company is soon to be organized in town, M. F. Sargent and R. Farquharson being the chief promoters in the scheme. One portion of the water power at the Boltonville Falls has been secured already and an option obtained on the remainder, so it is expected that before many months a fully equipped plant will be in operation with power enough to supply the entire Wells River Valley.

PULASKI CITY, VA.—The Town Council has employed an engineer to investigate water sites around the city, with a view to constructing an electric plant to light the town and run the water pumping station.

RICHMOND, VA.—At a meeting of the city committees on finance and electricity, M. H. Trafford, who had been appointed to investigate the question, reported strongly in favor of municipal ownership of a lighting plant.

RICHMOND, VA.—The Southern Bell Telephone Company will spend $100,000 in the construction of a new system between Richmond and Danville, taking in the towns of Keysville, Charlotte Courthouse and Chase City, along the Southern Railway.

NORFOLK, VA.—It is rumored that all of the electric street railway and lighting concerns are to be taken over by a new company which represents the interests of the Middendorfs, John L. Williams & Sons, and others. It is said that the plants at Norfolk, Berkeley and Portsmouth will be included in the deal; also that a $1,000,000 power station will be erected, together with about $1,000,000 worth of additional improvements. The power plant will develop 15,000 hp. The title of the new organization will probably be the Norfolk & Portsmouth Traction Company. If the deal is consummated the company will control 112 miles of lines besides other properties.

EVERETT, WASH.—The Seattle-Tacoma Power Company, of which O. D. Colvin, of Seattle, is manager, has decided to erect a substation at Everett.

BREMERTON, WASH.—The City Council has under consideration the installation of a municipal lighting plant and will take definite action upon the matter in the near future.

SPOKANE, WASH.—The Pacific States Telephone & Telegraph Company plans to spend $500,000 in extending and improving its system in the Spokane country, with the idea of securing greater business among the farmers of the Inland Empire.

SEATTLE, WASH.—Ground has been broken for the new power station of the Seattle Electric Company at Georgetown, which will cost when finished and equipped with machinery upwards of $250,000. The company, moreover, has plans drawn for the construction of large car barns, the total investment being upwards of $400,000.

OROVILLE, WASH.—Work has begun on the big power plant at Similkameen Falls. The project is owned by the Similkameen Falls Power & Development Company. With the machinery now being put in the plant will have a capacity of 1,000 hp, and it is so arranged that another 1,000 hp can readily be installed. With the entire falls utilized many thousand horse-power can be secured. Practically all the power to be produced at present has been contracted for and will be used in the mines and in lighting the town of Oroville.

SPOKANE, WASH.—C. Lunceford and associates, who recently incorporated the Inland Power & Electric Company, have opened offices in the Mohawk Building. The company has secured water rights from Idaho for Albani Falls, on the Pend d'Oreille River, near Newport. The capacity of Albani Falls is estimated at 20,000 hp. The company also has Hell Gate, in the Columbia River, between Spokane and the Okanogan Rivers, with about 20,000 hp, and the Metalline Falls of Pend d'Oreille River, in Stevens County, between Newport and the Canadian line. The company has been incorporated for $1,000,000.

SEATTLE, WASH.—Fred E. Sander has taken a contract to build two miles of electric railway in connection with the system which he is constructing between Seattle and Everett, to extend from the corner of Brig Street and Second Avenue in Ballard to Loyal Heights. This branch of the electric railway being constructed by Mr. Sander will be operated by the same power as the line to Everett and the cars of the Sander Interurban will be used in its operation, but the control of the trackage will be in the hands of a few Seattle men who have summer homes at Loyal Heights. A separate company is being formed, to be known as the Loyal Heights Electric Company, to control this branch line. H. W. Preat, Moritz Thomsen and J. G. Trenholme are interested in the project.

WINONA, WIS.—An effort is being made by the La Crosse Water Company to obtain a franchise in this city to furnish light and power. The company will expend about $1,000,000 in developing the water power.

GREEN BAY, WIS.—The lines of the Brown County Telephone Company, operating in rural districts of Brown and Manitowoc Counties, are to be considerably extended and the capital stock of the company will be increased soon from $10,000 to $20,000. Charles A. Straubel is president, and F. J. B. Duchateau is secretary and treasurer.

MILWAUKEE, WIS.—The Common Council has passed the franchise giving to the West Shore Telephone & Telegraph Company the right to build an independent system of telephones in Milwaukee. According to the ordinance, the company must begin business within four months from the present time, must expend $100,000 within six months after it starts to build, and must install 5,000 telephones within three years. The city offices are to have free service. The company is required to connect with all State independent lines which demand connection at the city limits.

SAN JUAN, PORTO RICO.—Bids will be received until May 1 by Capt. Frank C. Wood, Quartermaster, U. S. A., for supplying the electricity required for lighting the public buildings, grounds and fortifications under the control of the quartermaster's department at San Juan during the fiscal year ending June 30, 1907.

ST. JOHN, N. B.—The St. John Street Railway Company has secured the contract to light the city for ten years with 2,000-cp lamps at $75 per lamp per year.

PETERBOROUGH, ONT.—The city, which has, in its private bill to the Ontario Legislature applied for permission to acquire water-power and supply electricity to manufacturing concerns, has just received an order from the Peterborough Light & Power Company to furnish any factories with power up to 2,000 horse-power for a period of ten years at the rate of $20 per horse-power per year. The offer is under consideration.

TORONTO, ONT.—North Toronto will be permitted to go into the business of developing electric energy for the purpose of supplying street lights and heat to public buildings, and of selling light, heat and power to corporations or individuals. This permission was accorded by the Private Bill Committee.

WESTBURY, ONT.—The Westbury Electric Power & Light Company has recently installed a 75-kw, 3-phase, 60-cycle, 3,300-volt generator, belted to a water wheel. Mr. H. A. Worby, of East Angus, Que., is the proprietor.

New Industrial Companies.

STURGEON BAY, WIS.—The Sturgeon Bay & Northern Traction Company has been incorporated with a capital of $25,000, by Joseph A. Becker and others.

UNITED ELECTRIC SIGNAL COMPANY, Attleboro, Mass., has been incorporated with a capital of $200,000, by Stephen A. Wood, Joseph C. Estes, Louise R. Barrett.

WISCONSIN BRAKE & ELECTRIC COMPANY, Milwaukee, Wis., with a capital of $5,000, has been incorporated by W. D. Hickman, J. A. McCormick and P. W. Boehm.

AUTOMATIC SWITCH COMPANY, New York, has been incorporated, with a capital of $100,000 and the following directors: O. R. Denman, F. M. Coffin, William Sorrell, New York.

EGAN ELECTRIC MASSAGE VIBRATOR COMPANY, Petersburg, Ill., having a capital of $2,400, has filed articles of incorporation. The incorporators are Charles E. Egan, John Shurie and T. W. McNealy.

AVERY PORTABLE LIGHTING COMPANY, Milwaukee, Wis., has filed articles of incorporation with a capital stock of $10,000. Edgar C. Avery, George E. Burnham and E. G. Comstock are the incorporators.

THE UNITED MULTI-PHONE COMPANY, Wilmington, Del., composed of manufacturers of talking machines and of phonographs and phonograph records, was incorporated by Wilmington incorporating agents, with a capital stock of $1,000,000.

THE ELECTRICAL PRODUCTS COMPANY, Ravenna, Ohio, has been incorporated with $250,000 capital stock. W. B. Marshall, superintendent, states that the company will erect a plant for the manufacture of carbons and other electrical products.

VIELE, COOPER & BLACKWELL, New York, have organized with the following directors: Maurice A. Viele, New York; Hugh L. Cooper, Stamford, Conn., and Francis O. Blackwell, Englewood, N. J. The company will do mechanical, electrical and hydraulic engineering and contracting. Its capital is $1,500,000.

THE AMERICAN ENGINEERING & CONSTRUCTION COMPANY, 213 Eagle Building, Brooklyn, N. Y., has just been incorporated by R. C. Taylor, Edward Taylor and J. J. Sides, practical electric railway and power plant engineers. The company is prepared to handle any class of mechanical, electrical and construction work, and will also act as consulting engineers in drawing up or reviewing designs and specifications of complete plants, or apparatus to fulfil standard or special requirements.

New Incorporations.

JUNCTION, ARK.—The Junction City Light & Water Company has been incorporated, with a capital of $10,000.

SALINAS, CAL.—The Greenfield Light and Water Company has been incorporated with a capital stock of $25,000. The directors of the company are: A. Parker, J. B. Clark, J. G. Yoeman, G. W. Crandall, L. T. Odell, H. P. Lehr, of Greenfield, and J. A. Brock, of Los Angeles.

HARTFORD, CONN.—The Tri-City Railway & Light Company, of this city, has filed a certificate of incorporation with the Secretary of State. The amount of the authorized capital stock is $12,000,000.

WILMINGTON, DEL.—The Delmarvia Telephone Company and the Wilmington Electric Light & Power Company, which was recently granted a franchise by the Street and Sewer Department, have been merged. The new company will be known under the corporate title of the Wilmington Light, Power & Telephone Company. The Delmarvia Telephone Company had a capitalization of $300,000 and the Wilmington Electric Light & Power Company was capitalized at $1,000,000, and the merged corporation will have a capital of $1,250,00. The same men were interested in both companies, and they comprise the officers and directors of the new concern. The officers of the Wilmington Light, Power & Telephone Company are: President, Charles C. Kurtz, of Wilmington; vice-president, George R. Webb, of Baltimore; secretary and treasurer, Stanley Baker, of Wilmington; directors, Mr. Kurtz, Mr. Webb, Horace W. Gause, Samuel K. Smith, Alfred I. du Pont, Pierre S. du Pont and Henry P. Scott. The Wilmington Electric Light & Power Company, after it was granted a franchise, bought the old Jessup & Moore warehouse on the north side of the Brandywine, west of Pine Street, where a power plant will be erected.

CAPRON, ILL.—Capron Home Telephone Company, Capron; capital, $800; operate a telephone system; incorporators, F. D. Cornwall, E. W. Dimond, George H. Olson.

PEORIA, ILL.—The Peoria, Pekin & Tremont Telephone Company has been incorporated with a capital stock of $2,500. The incorporators are A. J. Davis, Walter H. Ames and S. A. Hayward, of Tremont.

NORTH McDONOUGH, ILL.—North McDonough Telephone Line, with a capital of $800, has been incorporated and will operate a farmers' telephone line; incorporators J. Geltmacher, Charles Edie and Frank Wille.

LA FAYETTE, IND.—The Lafayette & Logansport Traction Company, with a capital of $500,000, has been incorporated by Frank H. Cutshall and others, and will build an interurban line between Lafayette and Logansport.

DES MOINES, IA.—The Iowa Gas-Electric Railway Company was organized at this city for the purpose of building the connecting link in the proposed chain of interurban lines from Sioux Falls to Kansas City.

LONG LAKE, MINN.—The Hennepin Telephone Company has been formed with $25,000 capital and will extend lines to neighboring villages.

HAWK CREEK, MINN.—Hawk Creek Telephone Company, with a capital of $5,000, has been incorporated by P. E. Symes, G. P. Mangarud, E. O. Oppegaard, Steve Odegard, O. M. Agre.

HERMAN, MINN.—Herman Telephone Company, with a capital of $50,000, has been incorporated by C. J. Bacon, H. A. Hanson, G. F. Houston, J. D. Houston, A. W. Wells, John F. Lenden, K. C. Helgeson, E. E. Peck, Houston.

TRUXTON, N. Y.—Papers of incorporation of the Truxton & Cuyler Telephone Company have been forwarded to the Secretary of State. The company is incorporated for $10,000. The directors for the first year are: Frank L. Hilton, Fred R. Bryant and Fred J. Woodward of this village; H. D. Theobald, M. B. Dunbar and J. B. Whitmarsh, of Cuyler, and Randolph Hibbard, of Cortland.

CHATTANOOGA, TENN.—The Chattanooga Railway Company is the title of the new company recently incorporated by Graham & Co., of Philadelphia, who have purchased all the street railways of Chattanooga, including the Chattanooga Electric Railway and the Chattanooga Rapid Transit Company. The capitalization of the consolidated companies comprises a slight reduction in fixed charges and is based on conservative lines. A considerable sum has been provided for extensions and improvements.

Legal.

TELEPHONE PROTECTOR LITIGATION.—A decision has been rendered by Judge Anderson, in the U. S. Circuit Court for the District of Indiana, which disposes of eleven suits brought by Frank B. Cook against the Sterling Electric Company, of Lafayette, Ind. The decision did not involve an adjudication on the validity of the patents involved, that not being in question, but affected the ownership of the patents. It appears that Cook instituted the several suits for an injunction and an accounting, and claimed infringement, these patents taken out by him covering important features of protectors for telephone exchanges and instruments, cables, cable terminals, line fuses, and other important details. The Sterling Company instead of filing an answer to the complaint filed a plea in which it asserted ownership itself of all the patents at stake, and denied any possible infringement. The case was fought out on these lines, testimony being taken by the master in chancery. The master sustained the Sterling ownership pleading, and on March 21 Judge Anderson affirmed and sustained the master's report.

Personal.

MR. AUGUSTUS SPIES, president of the Menominee & Marinette Light & Traction Company, of Menominee, Mich., has been elected Mayor of Menominee.

MR. J. C. SLIPPY, of Waterloo, Ia., has accepted a position with the engineering department of the Central District and Printing Telegraph Company, of Pittsburgh.

MR. W. S. BARSTOW has returned to New York City from a trip of some two months through the Northwest, where he has been engaged on some large electrical consulting work.

MR. C. A. LAMBACH, formerly construction superintendent of the Independent Telephone Company, Council Bluffs, Ia., has been made manager of the new exchange, now being installed.

MR. CLOYD MARSHALL, who is actively identified with the American De Forest wireless interests in St. Louis, has been a visitor in New York the past week, and reports great progress in the work there.

MR. F. V. T. LEE has been appointed assistant manager of the San Francisco Gas & Electric Company, which has consolidated so large a portion of the electric lighting and gas interests in that city.

MR. LESTER G. SCOTT has severed his connection with the Westbrook (Me.) Electric Light & Power Company, to accept a position with the Consolidated Electric Light Company, of Portland, Me. Mr. George A. Brown will succeed him.

MR. ALBERT SCHEIBLE, who has been secretary and treasurer of the George Cutter Company ever since its organization 16 years ago, and whose work is well known to all users of that company's specialties, has resigned to head a new manufacturing company with headquarters at Chicago.

MR. GEORGE H. CLIFFORD, secretary of the Northern Texas Traction Company, has been appointed general superintendent of the operating department of the company and will look after all details of the operation of cars, etc., on the Interurban, the Dallas and Fort Worth lines. Mr. Clifford has been with the company five years.

MR. HERBERT A. WAGNER, the consulting electrical and mechanical engineer, has removed his New York offices to 60 Wall Street, which has already become quite an electrical enginering center. As a pioneer in single-phase motor work some 15 years ago, Mr. Wagner finds himself now very distinctly in the forefront of affairs.

PROF. C. A. ADAMS, of the electrical engineering laboratory, Pierce Hall, Harvard University, has gone through a prolonged siege of sickness, but is convalescent and has just returned from a trip of recuperation in the South. He is gradually getting back into harness, but for some time it will be necessary for him to take things rather easily.

MR. E. R. WEEKS, consulting engineer at Kansas City, has been selected by Waddell and Heidrick, engineers of the Great Intercity viaduct at that place to design the electric lighting and lighting plant for this structure. This viaduct which is to connect Kansas City, Mo., with Kansas City, Kan., will be about two miles in length.

MR. BANCROFT GHERARDI, assistant chief engineer of the Consolidated New York Telephone Company, is the subject of an illustrated biography in the *Sibley Journal of Engineering*. He graduated from Cornell University in 1893 and since then has had a useful career in the telephone field and as an active member and officer of the American Institute of Electrical Engineers.

MR. W. M. McFARLAND, vice-president of the Westinghouse Electric & Manufacturing Company has an interesting article in the *Engineering Magazine* for April, on the efficiency of the engineering personnel of the Navy. Mr. McFarland is a graduate of the Naval Academy and takes a deep interest in its professional questions, although it is now some years since he left the service.

MR. E. N. FOSS, general manager of the B. F. Sturtevant Company, of Boston, Mass., and prominently identified with many other large interests throughout the country, sailed for the Mediterranean, to be absent two or three months. Primarily the trip is for a much needed rest, but

Mr. Foss will, during his absence, make a careful study of foreign industrial and commercial conditions as related to trade with the United States.

MR. E. G. WATERS.—Mr. Edward G. Waters, formerly private secretary to Gen. Eugene Griffin, first vice-president of the General Electric Company, has returned to this country recently and has been appointed assistant to the first vice-president, with headquarters at Schenectady. Mr. Waters has had a long and useful connection with General Electric interests, including three years just past at the British Thomson-Houston works at Rugby in a managerial capacity.

MR. I. A. TAYLOR.—Note has not before been made in these pages of the death of Mr. Irving A. Taylor, on February 27, at the Montreal General Hospital, following an operation for hernia. He was only 32 years of age, and at the time of his decease was general superintendent of the St. Lawrence River Power Company, Massena, N. Y. He leaves a widow. Mr. Taylor was an associate member of the American Institute of Electrical Engineers, which he joined in 1898.

MR. F. A. PERRET.—Mrs. Charles Perret, of Brooklyn, was greatly relieved early last evening when she received a cable message from her son, Frank Alvord Perret, assistant director of the Royal Observatory on Mount Vesuvius, saying that he was safe. The press dispatches telling of the destruction of the observatory had caused Mrs. Perret great anxiety. Mr. Perret is an electrical engineer. About eighteen months ago he went to Naples for the benefit of his health, and while there made the acquaintance of Dr. Matteucci, the director of the Royal Observatory. Mr. Perret took an interest in Dr. Matteucci's work and became an assistant to him.

MR. EDWARD T. WALSH, who has for five years past been connected with the Interborough Company in the general design of the 59th Street power plant of the Subway Division, has resigned to accept the position of assistant engineer of construction of the National Cash Register Company, Dayton, Ohio. Mr. Walsh has had an extensive experience in power plant and structural steel design. His early experience consisted of a number of years upon the cable railway system of the Brooklyn Bridge, during which he secured his education at Pratt Institute. Subsequently he was employed three years by the Atlas Portland Cement Company in power plant and building design from which position he came to the Rapid Transit Subway Construction Company.

MR. G. W. W. KITTREDGE.—Mr. George W. W. Kittredge, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway, has been appointed chief engineer of the New York Central and Hudson River Railroad Company, with offices in New York. His appointment took effect April 9. He will be chief engineer not only of the New York Central, but also of the West Shore. Mr. Kittredge succeeds Mr. H. Fernstrom, who resigned some months ago. He is 50 years old, and was born in North Andover, Mass. Graduated from the Massachusetts Institute of Technology in 1877, he entered the employ of the Pittsburg, Cincinnati & St. Louis Railway. Until 1890 he was connected with the Pennsylvania lines west of Pittsburg.

MR. VAN RENSSELAER LANSINGH, illuminating engineer and general manager of the Holophane Glass Company's sales department, has recently lectured on illuminating engineering at a number of cities in the far West. At Portland, Ore., he lectured before the electric lighting fraternity of the city at the rooms of the Portland General Electric Company. He also lectured before the electric light interests at Seattle and Butte. At Salt Lake City he lectured on illuminating engineering before the Commercial Club and made an address on street lighting before the Real Estate Association and later before the city council. At Denver, he gave three lectures before the engineering and new business departments of the Denver Gas and Electric Company.

PROF. F. R. HUTTON, secretary of the American Society of Mechanical Engineers for nearly 25 years, presented to the council at its meeting in January his letter of resignation, believing that the work of the society now requires a secretary who can devote his whole time to the office. Professor Hutton's position as head of the department of mechanical enginering of Columbia University makes it impracticable for him to do this. The resignation was not accepted, and it is hoped that some compromise may be effected. It is suggested that Professor Hutton be made honorary secretary, with an active associate in the office. At the meeting of the council on March 27 this general plan was approved and a special committee was appointed to select a new man and arrange the details.

News of the Trade.

THE BERKSHIRE ELECTRIC COMPANY, of Pittsfield, Mass., has sold its Lenox branch to Benjamin Rodgers, formerly local manager at that place, who will continue the business under the style of B. H. Rodgers & Co.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received orders from the Southern Power Company, of South Carolina, for eight 4,000-hp electric generators and twelve 2,500-hp oil-insulated water-cooled transformers and auxiliary apparatus.

HABIRSHAW.—The sales department of the India Rubber & Gutta Percha Insulating Company, of Yonkers, N. Y., will be removed from 15 Cortlandt Street, New York, on May 1, to the Postal Building, 253 Broadway, where Mr. J. B. Olson, manager of the department, will continue his successful work for the well known Habirshaw wires and cables.

THE MARINE ENGINE & MACHINE COMPANY has outgrown its present quarters, and the increase in its elevator business having necessitated larger premises, it has taken a new building at 230-232 West 13th Street, New York. The headquarters and the elevator construction department will be located here, where it will have the benefit of up-to-date conditions and facilities.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., manufacturer of electrical apparatus, has increased its capital stock from $100,000 to $150,000. The company has recently been erecting a new plant at 133 Stewart Street and is now occupying a part of it and increasing its output materially. About 100 men are employed in the manufacture of small electric motors and generators. Louis Allis is president and F. H. Petrie, secretary.

THE CONSOLIDATED ENGINE STOP COMPANY has recently moved its offices and factory to 130 East Twelfth Street, New York. It has secured excellent facilities in a new building for its offices and machine shop. An entire floor comprising 4,500 sq. ft. has been leased. There are well-furnished offices in the front part and a machine shop back of the offices. In this way it was felt that a more thorough supervision could be secured over the manufacturing of the various types of engine stop produced by the company.

THE PITTSBURG PIPING & EQUIPMENT COMPANY, Pittsburg, Pa., announces that on March 30, 1906, the general offices were moved from the Westinghouse building to its own office building at the shops, No. 3422-28 Smallman Street. Additional property has been purchased to provide for the accommodation of the offices and for a much needed shop extension. The Cleveland office has also been moved from the Rose Building to new and larger quarters at No. 53 Public Square. The company is better prepared than ever before to give prompt and careful attention to any business with which it may be favored, and trusts that its work in the past will warrant the sending to it of future inquiries and orders.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 3, 1906.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N. Y.]

816,554.—ELECTRIC FURNACE; Anson G. Betts, Troy, N. Y. App. filed May 20, 1904. In combination, an electric furnace comprising a furnace-chamber adapted to contain on its hearth a bath of liquid conductor; a channel leading into said chamber, and adapted to contain liquid conductor; electrodes arranged to supply electric current to pass through the liquid conductor in the channel; and means for causing motion of liquid conductor through the channel to the bath on the hearth.

816,612. FLEXIBLE CONNECTION FOR GEARLESS MOTORS; Robert Siegfried, Pittsburg, Pa. App. filed Dec. 18, 1905. The combination with an axle having a wheel provided with a set of chambers, a quill or sleeve surrounding the axle and provided with bosses that project into the chambers, and resilient cushioning means that surround the bosses within the chambers of resilient cushioning means between the ends of the bosses and the wheel.

816,619. TELEPHONE DESK-STAND; Henry Tideman, Menominee, Mich. App. filed Sept. 14, 1905. In a telephone desk-stand, a base, a cap, a web attached to said base and said cap and forming a part of the shaft connecting them, and a detachable plate forming the completing portion of the shaft between base and cap, substantially as described.

816,636.—ADJUSTABLE SUPPORT FOR INCANDESCENT ELECTRIC LAMPS; Oscar T. Banks, London, England. App. filed Oct. 6, 1904. A support for incandescent lamps which is adjustable to varying lengths so as to be received within porcelain casings or candles of different lengths. The receptacle is so formed as to receive a considerable amount of slack cord so as to accommodate different lengths thereof.

816,676. MECHANISM FOR OPERATING RAILWAY SIGNALS; William V. Moak, Utica, N. Y. App. filed July 13, 1905. The danger and the caution semaphore signals have rod connections extending to separate crank arms which can be clutched into engagement with a motor by a pair of spring operated clutches. Pneumatic cylinders are provided for cushioning the movement.

816,753. CEMENT-BURNING FURNACE; Willoughby E. Snyder, Nazareth, Pa. App. filed July 20, 1904. In a cement-burning furnace the combination with a movable hearth provided with a reverberatory hood, of a series of pairs of arc electrodes operatively disposed within the hood above the hearth, and draft-compelling means adapted to produce a current of air in opposition to the direction of movement of the hearth.

816,762. APPARATUS FOR CONTROLLING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; Louis H. Thullen, Edgewood, Pa. App. filed Jan. 18, 1905. The switch point is connected to a continuously rotating motor through a magnetic clutch which is normally inoperative, but which can be energized by the signal or pilot circuit. An interlocking means is provided for insuring a proper setting of the signals determined by the movement of the switch point.

816,764.—PROCESS OF SMELTING LEAD ORES; William Valentino and Anson G. Betts, Troy, N. Y. App. filed June 15, 1904. The process of recovering lead from lead-sulfid ores which consists in fusing the ore and accompanying gangue into a matte and a slag, and

electrolytically separating lead from the matte by bringing the matte into contact with a cathode in a fused electrolyte in which lead sulfid is substantially insoluble.

816,792.—LOCK; Oliver H. P. Green and Delos Carpenter, Ohion, Mich. App. filed Sept. 6, 1904. Mechanical construction of an electric lock having a bell-crank lever connected to the usual bolt, and an electro-magnet acting on the free arm of such lever.

816,804. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed Jan. 18, 1905. Relates to a complete system of motor control especially designed for elevator installations in which the motors works on a three-wire alternating current circuit. Has a generator connected to the motor and arranged to control the resistance in proportion to the speed of the motor on starting.

816,805. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed June 14, 1905. Additional details of the above system relating particularly to the starting switch and a single magnet energized by pulsating and direct currents for operating said switch.

816,806. ELECTRIC TRACTION ELEVATOR; Axel Magnuson, New York, N. Y. App. filed Nov. 17, 1905. A special form of magnetic clutch in which a series of magnets are inset around the periphery of a revolving part and have their poles grooved to constitute a sheeve or pulley for the reception of a wire cable which is grasped when the magnets are energized.

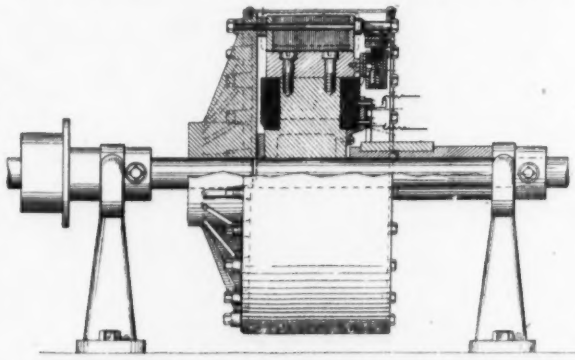
816,819. TWO-DIVISION TELEPHONE SYSTEM; Howard M. Post, Chicago, Ill. App. filed Oct. 24, 1902. In a telephone system, the combination with a telephone-line, of a plurality of relays therefor, at the central office, parts controlled by said relays and means for causing the operation of said relays singly from the substation and simultaneously from the central office, substantially as described.

816,847. IRON-FRAMED DISTRIBUTING-BOARD FOR TELEPHONE EXCHANGES; Frank B. Cook, Chicago, Ill. App. filed Feb. 2, 1903. In a distributing-board, the combination of a supporting-frame having rearwardly-extending arms a terminal block secured to the rear end of each of said arms, said blocks being arranged in rows both vertically and horizontally, and a conductor-supporting ring associated with each block.

816,869. ELECTRIC ELEVATOR SYSTEM; Axel Magnuson, New York, N. Y. App. filed May 23, 1905. Construction of an elevator brake in which a strong spiral spring is mounted to normally apply the brake through a toggle lever, and a pair of magnets having two windings, one for alternating currents to release the brake, and the other for direct currents to hold it in released relation.

816,875. TROLLEY HARP; Barney Murphy, New Haven, Conn. App. filed Aug. 24, 1905. A form of trolley harp swiveled to the extremity of the pole so as to be movable on a vertical axis. A projecting bail engages a hook on the pole to limit the movement.

816,894. APPARATUS FOR TELEPHONE SWITCHBOARDS; Henri E. A. Andre, Paris, France. App. filed Apr. 27, 1904. The combination with a number of telephone lines each provided with multiple connection-terminals at a central switchboard, of an answering and a calling plug, a link conductor connecting said plugs for uniting any two of said lines at the connection-terminals thereof, a central-office telephone apparatus adapted to be connected with said link conductor, a local circuit established in the act of making connection from either plug to the terminal of any busy line, a relay in said local circuit, blocking mechanism controlled by said relay for rendering the central-office telephone apparatus inoperative for communication over said link conductor, and means actuated in making connection with any line for establishing at the several multiple terminals of such line a peculiar electrical condition to which the said relay is responsive when the circuit of said relay is established at another multiple terminal of the same line, whereby the central-office telephone apparatus is automatically blocked when it is attempted to make connection with a busy line.



816,912.—Dynamo Magnetic Power Transmission Device.

816,903. COMBINATION BLOCK AND FAN; Spencer D. Earl, Norristown, Pa. App. filed May 5, 1905. A small fan motor is permanently attached to the frame of an ordinary clock and is operated by a circuit which is intermittently interrupted by the clock mechanism so that the fan is driven intermittently.

816,912. DYNAMO MAGNETIC POWER TRANSMISSION DEVICE; John O. Heinze, Jr., Lowell, Mass. The patentee secures upon the engine shaft a special form of generator or clutch which has circuits controllable by the operator. The purpose is to vary the effective speed and torque of the generator without varying the rotation of the engine.

816,922. ELECTRIC METER; Robert C. Lanphier, Springfield, Ill. App. filed Mar. 9, 1904. Relates to a type of wattmeter in which a metallic disc floats in a mercury bath. The series circuit passes through the disc and the shunt circuit through the fields in which the disc revolves. Means are provided for passing a part of the shunt circuit through the armature in starting so as to give a sufficient starting torque on light loads.

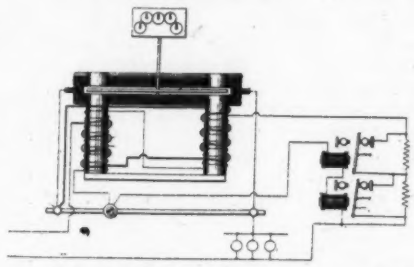
816,928. PROCESS OF PRODUCING AMMONIA; John A. Lyons and Edward C. Broadwell, Chicago, Ill. App. filed Sept. 2, 1904. The process of subjecting a fused bath of the borates of electro-positive metals to electrolytic action and subjecting the anion produced thereby to a reducing agent at the anode in the presence of an intense heat and introducing nitrogen into said bath at the anode and then subjecting the boron nitrid thus produced to steam.

816,930. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed June 13, 1905. Relates to the operation of elevator motors having a generator connected to run with the motor, and having means dependent upon the action of the generator for causing the movement of the motor to actuate a controlling device.

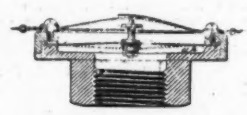
816,931. SYSTEM OF MOTOR CONTROL; Axel Magnuson, New York, N. Y. App. filed Nov. 16, 1905. Relates to modifications of the above, and features of the various circuits by which the generator current is controlled through the operating device.

816,948. CONTROLLER FOR AUTOMATIC TELEPHONE SYSTEMS; Alton E. Stevens, Fall River, Mass. App. filed July 12, 1905. A shaft; a cam mounted thereon; a contact-arm; a series of contacts with which the contact-arm may be moved successively into engagement; a series of manually-operated parts operatively connected with said cam, whereby said contact arm may be moved into engagement with one or more of said series of contacts.

816,981. CROSS ARM FOR ELECTRIC OR SIGNAL WIRES; Anthony H. Iliohan, Oakland, Cal. App. filed Mar. 21, 1905. In order to prevent creepage of currents over the surface of the insulator in wet or foggy weather, the patentee makes the usual cross arms in the form of an inverted box, and the conductors are held by insulated arms depending from the interior of such box.



816,922.—Electric Meter.



817,009.—Automatic Alarm for Gas Pipes.

816,991. ART OF SUSPENDING AERIAL CABLES; Lenard A. McNeil, Maywood, Ill. App. filed Sept. 2, 1904. A pair of star wheels form a permanent part of the supporting fixture or bracket for the cable and are so arranged as to permit the cable to be stretched tight, and subsequently locked in such stretched relation.

817,009. AUTOMATIC ALARM FOR GAS PIPES; August L. Schultz, Cleveland, O. App. filed Nov. 28, 1904. A plug is inserted at the end of an ordinary gas pipe which has a diaphragm therein, the movements of which open and close an alarm circuit so as to indicate any dangerous drop of pressure in the pipe.

817,031. CONTROLLER; Thorsten Von Zweigbergk, Preston, England. App. filed May 15, 1903. A motor starting device having a rheostat arm moved over contacts by a Geneva stop motion. The Geneva stop motion is driven by an electric motor differentially wound with shunt and series coils.

817,036. AUTOMATIC BLOCK SIGNAL SYSTEM; Abram L. Bower, Boyertown, Pa. App. filed Jan. 31, 1903. Discs at the various stations have spaced contacts therein and are stepped around by pawl and ratchet devices so as to alternately illuminate and extinguish certain signal lamps.

817,057. FLEXIBLE METALLIC TUBE; Edwin T. Greenfield, Monticello, N. Y. App. filed Oct. 24, 1904. A construction of sheet metal armor for flexible cables of large diameter in which a convex and a concave strip are wound so as to interlock together, and are corrugated to give greater rigidity.

817,082. APPARATUS FOR SUBJECTING AIR TO ELECTRIC DISCHARGES; John E. Mitchell and Dennis Parks, St. Louis, Mo. App. filed Jan. 3, 1906. In an apparatus for modifying air by the electric discharge, in combination with a yieldably-mounted electrode, a pair of electrodes reciprocable into and out of contact with opposide ends thereof, said electrodes being connected with a suitable source of electricity.

817,086. CONDUIT FOR ELECTRIC WIRES; Daniel H. Murphy, Milwaukee, Wis. App. filed June 9, 1902. An iron pipe is galvanized with zinc on its exterior surface and is furnished with an enamel coating on its inside including varnish and linseed oil as ingredients.

817,131. AUTOMATIC RAILWAY SIGNAL; John Neumaier, Milwaukee, Wis. App. filed July 8, 1905. A metallic box is secured beneath the usual track rails and has an upwardly projecting finger in the path of the wheel flanges of the train. The finger completes special alarm circuits, and is adapted to be reset after depression by a train, by means of an electro-magnet within the box.

817,132. STORAGE BATTERY; William H. Palmer, Jr., New York, N. Y. App. filed Feb. 14, 1905. A storage-battery cell comprising a containing-jar, a series of positive and negative plates alternately disposed therein, the two groups supported from opposite ends of the jar, and means at the upper edges of the plates constructed to provide additional mutual supporting means, substantially as described.

817,137. APPARATUS FOR PRODUCING ELECTRIC WAVES; Alessandro Artom, Turin, Italy. App. filed Jan. 3, 1903. The combination with means to produce electrical current; of two discharge-terminals supplied with current therefrom and a third discharge-terminal arranged with respect to the other two at the vertex of a triangle, means to electrically connect said terminal in parallel with one of the other terminals and means to produce capacity in the electrical connection of the third terminal.

817,140. TELEPHONE-TRANSMITTER; William W. Dean, Chicago, Ill. App. filed Jan. 27, 1902. A telephone-transmitter comprising a flat main diaphragm, a ring secured to the back of said main diaphragm, a supplemental diaphragm secured to the back of said ring, said ring constituting a medium of non-yielding connection between the two diaphragms, a solid backing and non-yielding connection between said back and the middle portion of said supplemental diaphragm, front and back electrode-surfaces within the chamber provided between the two diaphragms, the front electrode-surface being movable with the main diaphragm, and the back electrode-surface being stationary and rigidly connected with said backing, and granular carbon interposed between said electrode-surfaces, substantially as described.

817,146. SWITCHING DEVICE FOR ELECTRIC LAMPS; John McCullough, Newark, N. J. App. filed June 23, 1903. An incandescent lamp of the type having a long and a short filament for normal and dim illumination. A cord passes through the socket and has a button thereon which presses a spring and throws the short filament into circuit whenever the cord is pulled.